June, 2003

NORTH AMERICAN WATERFOWL MANAGEMENT PLAN

STRENGTHENING the BIOLOGICAL FOUNDATIONS

2003

Implementation Framework

North American Waterfowl Management Plan
Plan nord-américain de gestion de la sauvagine
Plan de Manejo de Aves Acuáticas de Norteamérica

Signature Page [to be completed June03]

A. An acknowledgment of the importance and contributions of the North American Waterfowl Management Plan (Plan) to conservation, signed by the appropriate Secretary and Ministers of the United States, Canadian, and Mexican governments.

Contents

Preface

The North American Waterfowl Management Plan (Plan) was developed in 1986 as the framework for a 15-year effort to achieve the waterfowl population and habitat objectives deemed necessary to meet public demand in North America. Conservation achievements under the banner of the Plan have been phenomenal and today the Plan is a widely recognized conservation success. Nevertheless, some goals of the original Plan remain unfulfilled and new challenges continue to emerge. The need for international cooperation in the conservation of the shared waterfowl resource will continue into the foreseeable future. We believe a renewal of the Plan is warranted.

The Plan Committee has regularly made modifications to the Plan to account for biological, social, and economic changes that influence the status of waterfowl and recognizes the continued importance of waterfowl and wetlands to North Americans. Our intent in preparing the 2003 Plan is to define the needs, priorities, and strategies for the next fifteen years, to increase stakeholder confidence in the direction of Plan actions, and most importantly, to guide partners in strengthening the biological foundations of North American waterfowl conservation. To achieve all this, the 2003 Plan is presented in two separate documents. This document, ***Implementation Framework,*** provides an in depth discussion of the Plan's themes and includes several appendices of supporting information. The ***Implementation Framework*** is directed to those engaged in the joint ventures and other organizations to realize Plan objectives. The companion ***Strategic Guidance*** document is directed to Plan partners, agency administrators and policy makers and is comparable in length and scope to the 1986 Plan and the Updates of 1994 and 1998. It is our hope that the many thousands of partners involved in the conservation of our natural resources will find both of these documents useful in continuing their work.

(Plan Committee signatures)

Foreword

THe 1986 North American Waterfowl Management Plan transformed cooperative wildlife conservation. The Plan pioneered the shift in waterfowl management from an era dominated by harvest management and site-specific habitat protection into one where waterfowl managers are important participants in mainstream land-use decision-making on the working landscapes of North America.

The Plan is the collective product of a talented team of conservation administrators and biologists who had the vision to recognize the need to reinvent waterfowl conservation. They began their quest to restore and sustain North America's waterfowl with a commitment to erect a biological foundation capable of supporting a continental program, and took nothing else in the conservation *status quo* for granted. They looked beyond what *could* be done, to focus on what *should* be done. International borders were no more a constraint than were current organizational and financial capabilities or national legislation.

The genius of the Plan is in its straightforward framework for action and its shared implementation. The founders established a continental vision and a set of principles grounded in strong waterfowl and habitat science. They recognized that waterfowl habitat conservation had to extend beyond refuges and sanctuaries to cover vast areas of privately owned and managed lands. The Plan called for the establishment of habitat joint ventures where multi-sector partnerships could plan and implement locally relevant habitat conservation programs that met this challenge.

Waterfowl drew Canada, the United States, and later, Mexico, into a continental conservation effort through the Plan and fostered conservation partnerships encompassing diverse social, economic, and environmental interests. Following the Plan model, other bird groups, such as shorebirds, landbirds and waterbirds have developed their own geographically-based plans with population goals that can be translated into conservation actions on the ground. The Plan community must reaffirm its basic commitment to the science and conservation of waterfowl and their habitats, while participating in broader stewardship efforts for other birds and the global environment.

Plan habitat and waterfowl accomplishments have exceeded many 1986 expectations, though much vital work remains. The Plan has fostered the development of parallel conservation initiatives for virtually all groups of birds. But, we must not become complacent. In the face of globalization and complex environmental issues, the information, challenges and opportunities for conservation continue to evolve. Thus, it is essential that the Plan builds on its successes, recognize change, and redefine, recommit, and guide waterfowl conservation into the 21st century.

-- Rollin Sparrowe and James Patterson, June 2002.

Acknowledgments

National Statements of Conservation Context [to be completed by the respective country representatives near the end of drafting process.]

Each of the three federal wildlife agencies will state their approach to executing their Plan responsibilities and how they intend to incorporate each country's unique biological, social, and administrative factors in developing and implementing Plan activities

A. Canada

B. United States

C. Mexico

I. Strengthening Foundations, Building Partnerships

The 1986 North American Waterfowl Management Plan (Plan) initiated a new era in conservation. Building upon decades of experience, the Plan authors captured a growing consensus that a broad-scale, cooperative conservation effort was necessary. The founders of the Plan could not have foreseen the broad effects that it and subsequent Plan Updates would have. Plan joint ventures have become the standard template for planning and delivering regional conservation programs. Many of the goals in the original 1986 Plan have been achieved and transcended: for numbers of some waterfowl species, , acres of habitat conserved, dollars raised and dollars expended. Yet, at the end of the initial 15-year planning horizon, the job is far from done.

Today, various pressures continue to threaten the quantity and quality of waterfowl habitats and the conservation gains made under the Plan. Wildlife interests compete with powerful economic forces such as agriculture, energy development, and urban expansion. New threats continue to emerge: invasive species, competing demands for water, environmental contaminants, global climate change, and others. To meet these challenges, conservation efforts must continue to be aggressive across the entire range of waterfowl habitats in North America.

Beyond sustaining past accomplishments, we must move forward. We still lack basic knowledge of population dynamics for some waterfowl species. We need to better understand the linkages between habitat characteristics and waterfowl population responses. We need to address the persistent deficits in breeding habitat in the mid-continent prairie region. We need to act on the recognition that the boreal forest has emerged as a high priority area. We need to identify the conservation needs and geographic focus for sea ducks, scaup, northern pintails and other species requiring special attention. We need to explore new alliances with non-traditional conservation partners, such as agricultural producer groups, consumer groups, the forest industry, and water interests. Finally, we need to ensure greater coordination between species and habitat joint ventures, among related habitat joint ventures, and between national and regional institutions.

The 2003 Plan is the first comprehensive Plan document since 1986. It calls for a strong recommitment to the foundations of waterfowl conservation, even as it provides a fresh synthesis of the core elements of the 1986 Plan and previous updates (1994 and 1998).

The Plan retains its commitment to a landscape-approach, grounded in the broad collaborative partnerships defined in the 1998 Update, Expanding the Vision. With the advent of the North American Bird Conservation Initiative (NABCI) and common adoption of a landscape approach to conservation planning and delivery, the Plan community now needs to turn increased attention to the scientific work required to support waterfowl conservation. Hence the subtitle of the 2003 Plan: Strengthening the Biological Foundations.

The Plan's past successes are attributable, in part, to a strong historical biological foundation. This foundation has enabled partners to focus efforts objectively and make science-based decisions about where and how to conserve waterfowl habitats. Monitoring and assessing the impacts of Plan actions have demonstrably improved effectiveness. As joint venture partnerships diversify, as the Plan's geographic reach expands to places where we know less about the birds, and as regional conservation programs are developed for multiple suites of wildlife species, a stronger and broader scientific base will be even more important. Recognizing this, the Plan Committee formed the North American Waterfowl Management Plan Science Support Team (NSST) in 2000. The mission of the NSST is to help strengthen the biological foundations of the Plan and facilitate continuous improvement of Plan conservation programs. The NSST works with joint ventures and other Plan partners to identify methods for biological planning and to link regional scale evaluations to assess overall Plan performance the continental scale. The NSST was also responsible for preparing the technical information and recommendations contained in this Update.

The Plan's success to date and the evolution of joint ventures into significant conservation forces present their own on-going challenge. Our Plan community[1] must continue to review the appropriate working relationships among the various national-level institutions, joint ventures, the NSST, and the Plan Committee. The Plan Committee is committed to providing leadership within the North American waterfowl community and to working with Plan partners to assure the quality of Plan activities. The Plan Committee will play a more proactive role in the years between updates, seeking the latest scientific information, promoting adaptive management, assessing results of Plan activities, and facilitating communication throughout the entire waterfowl conservation community and beyond.

[1] The Plan community is defined as all the agencies, organizations, groups and individuals involved in Plan activities

II. Background

Historical Perspective

As the North American Waterfowl Management Plan enters a new phase with this Update, it is important to recognize that the original 1986 Plan was the fruition of a series of events in the evolution of migratory bird management in North America. Organized efforts to conserve waterfowl and other migratory birds began in the late 19th century in response to the growing commercialization of wildlife, especially through market hunting for food and feathers. Early conservationists soon realized that even federal laws were insufficient to fully protect birds that routinely crossed international borders. The migratory bird treaties and conventions between Canada and the United States in 1916, and in 1946 with Mexico provided the foundation for the development of cooperative migratory bird management.

These early treaties and subsequent legislation focused on specific regulatory measures to prevent over exploitation. It wasn't until the drought of the 1930's that more direct management actions were taken. During that time, wetland and grassland habitats were decimated and duck populations underwent precipitous declines. Recognizing the plight of ducks and wetlands and the lack of specific information to drive management efforts, the U. S. Bureau of Biological Survey sent field crews to Canada in 1934-1936 to learn more about waterfowl population levels and nesting conditions in the prairie and parkland regions. At the same time, Canadian biologists were studying the natural history and distributions of birds in Canada. These early investigations highlighted the need to establish systematic population surveys, obtain habitat and productivity data, and conduct annual banding operations. The first aerial winter survey in Mexico was conducted along the Gulf Coast in 1938. Private conservation organizations, notably the precursors to today's Ducks Unlimited and Delta Waterfowl Foundation, were formed by concerned sportsmen to support waterfowl conservation measures.

The first cooperative waterfowl breeding survey in the Canadian and U. S. prairies was launched in 1947. The Flyway Councils were formed in 1952, followed by the Flyway Technical Sections. Both aggressively promoted waterfowl management and research. By the late 1950s, Flyway Management Plans were developed in all four Flyways with specific objectives and strategies outlined to achieve desired population levels and to protect critical habitats. In the 1960s, Flyway Plans were followed by the preparation of species management plans for some ducks and Canada geese.

Cooperative Flyway Management Plans containing specific population objectives were initially developed in the 1970's. Regional Habitat Concept Plans were developed in the late 1970's, which identified continentally important waterfowl habitats that were threatened. In the U.S., a National Waterfowl Management Plan developed in 1982 was intended to provide the basis for cooperative management of waterfowl and to provide guidance for the development of more detailed Flyway plans. Meanwhile, Canadian waterfowl managers were becoming convinced that traditional conservation measures could never adequately meet the challenges within that country and that a new approach was needed. A seven year internal planning process involving the Canadian Wildlife Service and provincial governments was initiated. Efforts in Mexico were to begin later . Though the National plans in Canada and the U.S. provided guidelines for expanding waterfowl programs and were good coordination vehicles, they were never fully implemented. It soon became obvious that a broader continental initiative was needed.

The idea of developing an international waterfowl management plan was explored further by U.S. and Canadian officials and it was determined that this document would not be an international treaty, but would instead be considered "an International Agreement in Principle for joint resource management purposes". Thus, it would not require Senate approval in the U.S. or Parliamentary approval in Canada. Mexico was invited to join, but delayed participation until a better understanding of the Mexican role and commitment required could be determined.

It was recognized that a set of principles on the future needs of waterfowl management should be prepared to guide this long-range planning process and agreed that the proposed plan should be based on a 15-year horizon with updates at 5-year intervals. The initial intent of the Plan was to focus on the seasonal habitat requirements of the thirty-two principal species of ducks, geese and swans that were shared by Canada and the U.S., with priority given to breeding habitat. Habitat goals and objectives were established based on the original Habitat Concept Plans and other similar documents. Likewise, the Plan set population goals and objectives for the principal species of ducks, geese and swans, largely based on what was known about the relatively high population levels of the mid-1950's and the late 1970's. A realistic goal for most duck populations was determined to be the average breeding populations recorded during the decade of the 1970s. It was acknowledged that, for some species, data were insufficient to establish population goals and conservation strategies. Joint ventures and partnerships were proposed as the means to achieve cooperative efforts to meet the ambitious objectives.

The North American Wetlands Conservation Act

The 1986 Plan recognized that a higher level of funding support was necessary to implement the Plan's habitat objectives. It also concluded that acceptable procedures had to be developed for the U.S. to provide financial support for the Plan joint ventures in Canada. These needs resulted in passage of the North American Wetlands Conservation Act (NAWCA) in 1989, with strong support from Plan partners. The NAWCA provides matching grants to private or public organizations and to individuals to carry out wetlands and associated uplands conservation projects in the United States, Canada, and Mexico. This was a significant accomplishment in that it provided secure, long-term funding for habitat conservation projects and affirmed a partnership approach to achieving the Plan's goals in all three countries. Since 1989, NAWCA has supported more than 1,100 projects with $520 million in grants. Matching funds from partners has exceeded $1.5 billion.

In addition, it was recommended that the planning process provide data on population status and habitat conditions, but not become engaged in the annual hunting regulation setting process in each country. With these guidelines, a Drafting Committee was established in 1985. Following review throughout the waterfowl community, the final draft was completed in 1986, and signed a on May 14, by U.S. Secretary of the Interior l and Canadian Minister of the Environment

The Waterfowl of North America

North America's wetlands support a rich abundance and diversity of waterfowl. From subtropical whistling ducks to the hardy spectacled eiders of the Bering Sea, ducks, geese, and swans occupy every type of wetland habitat on the continent. From coastal marsh and southern hardwood swamps; to mountain meadows, rivers and prairie potholes; to rocky inter-tidal shores, beaver ponds, and arctic tundra – waterfowl flourish wherever healthy wetland ecosystems are found.

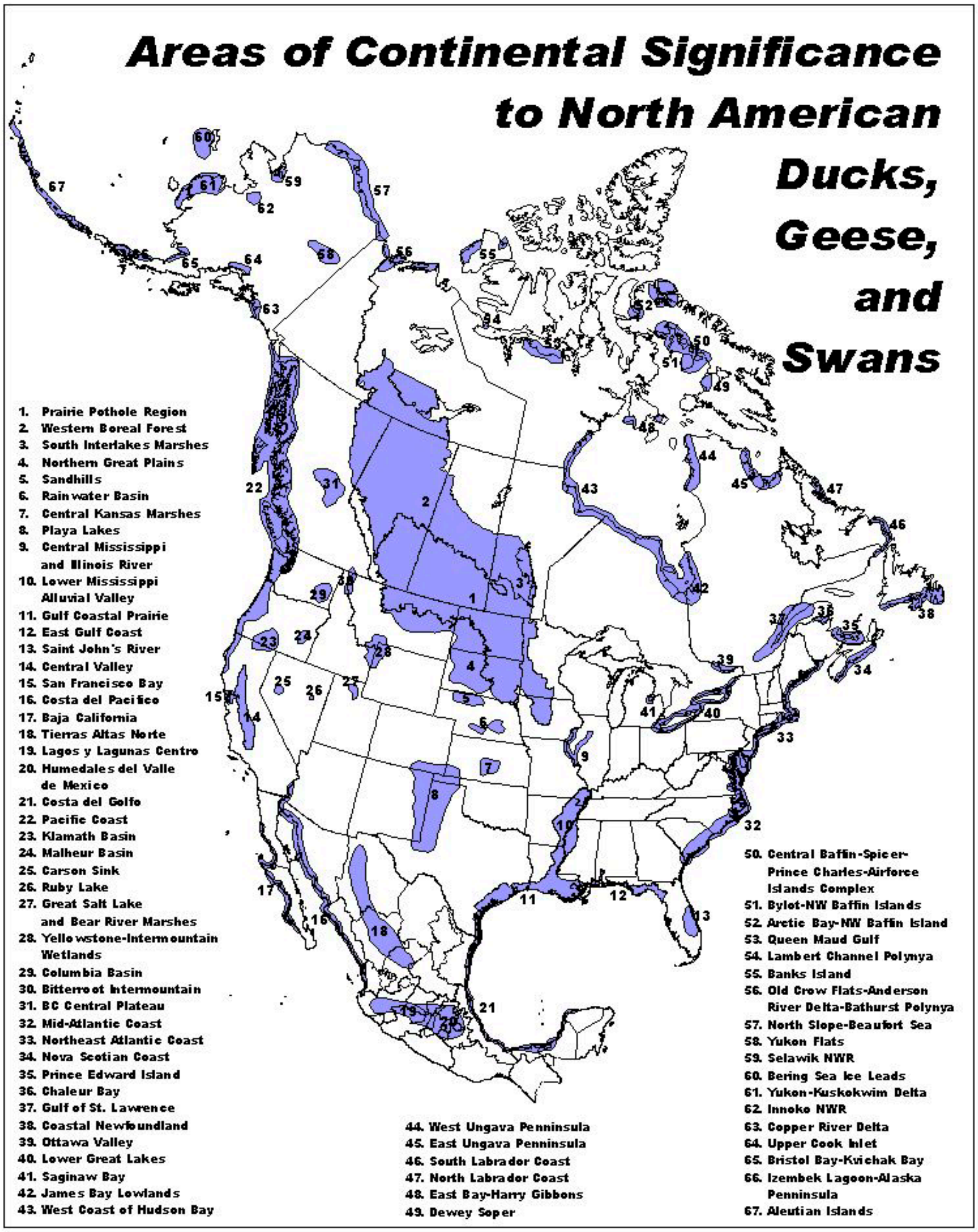
North America hosts seven of the nine tribes of the family *Anatidae;* two species of whistling ducks; numerous species and subspecies of the true geese and swans; thirteen species of dabbling ducks (which include most of the abundant and heavily hunted species); five species of pochards, or diving ducks; more sea ducks (fifteen) than any other continent; two species of stifftail ducks; the wood duck; and the muscovy (Appendix E).

Waterfowl exploit a wide variety of habitat niches. Swans are mainly aquatic herbivores, utilizing fairly shallow freshwater and estuarine habitats as well as flooded agricultural fields. Geese are mainly terrestrial grazers in arctic to mid-latitude regions, although some species (greater snow geese, for example) grub rhizomes extensively in wetlands and others graze aquatic plants in shallow marine systems (Pacific brant.) Most species also exploit farm fields at some point during their annual cycle. Dabbling ducks exhibit the widest array of habitat preferences: from generalists like mallards to specialized filter feeders, like northern shovelers, to grazers like American wigeon. The pochards include shallow-water plant eaters of fresh to brackish waters (such as ring-necked and canvasback ducks) and invertebrate predators in open water and marine habitats (lesser and greater scaup). And finally, sea ducks occupy the most northerly climes in winter, some diving deeply for bottom-dwelling bivalves.

Waterfowl populations are strongly affected by rainfall and related uncontrolled environmental variation. During the late 1990s, most species of prairie-breeding ducks responded to a decade of above average rainfall and unprecedented wetland conditions by recovering to near or above Plan goal levels. But these conditions are cyclic and with the inevitable return of dry conditions across the prairie pothole region breeding populations in the mid-continent area will again decline. In Mexico, nine years of drought in the Central Highlands have drastically reduced surface water resources. This has concentrated both waterfowl and humans around remaining wetland areas, increasing the risk of botulism, cholera, and other pathogens.

Some species, such as northern pintail, did not respond as expected during the recent wet period on the prairies. Scaup populations have been declining, for more than twenty years, and it is not clear why. Other birds that share the scaup's remote northern breeding grounds, such as white-winged scoters and surf scoters, have been in similar steep decline. Many sea ducks are believed to be declining, but in some cases data are inadequate to be certain. For other sea duck species declining trends are clear, but the causes are elusive. Certain goose populations continue to pose management challenges, either because of overabundance (e.g., lesser snow geese) or under abundance (e.g., dusky Canada geese). These persistent problems provide important context for this revision of the North American Waterfowl Management Plan and the Plan community's rededication to its vision and principles.

Figure 1



The 1986 North American Waterfowl Management Plan identified prairie pothole breeding habitat in Canada and the U.S. as "the top priority for protection." In the future, Plan success or failure will continue to be linked to long-term trends in waterfowl habitat conditions in the Prairie Pothole Region. The 1986 Plan also identified other regions with critical habitat conservation needs for waterfowl. As the biological foundation for waterfowl conservation has improved, and as Plan horizons have expanded to embrace the full spectrum of North American waterfowl, additional priority areas in all three countries have been recognized as critical to the continued maintenance of ducks, geese, and swans throughout the annual cycle. While habitat conservation, or monitoring, is important in every area of the continent, these areas require special attention and resources.

Plan Visions, Purpose, and Guiding Principles

The 1998 Update, *Expanding the Vision*, established three broad visions for the future of waterfowl conservation. These visions remain as pillars today, guiding the actions of the Plan's partners: the Plan Committee, Science Support Team, joint ventures, and the many agencies, organizations and individuals working to achieve Plan objectives.

- Plan partners define and attain the landscape conditions needed to sustain abundant waterfowl populations;
- Plan partners forge broad alliances with other conservation efforts and communities to achieve Plan objectives; and
- Plan partners continually improve the biological foundations of waterfowl conservation.

The purpose of the Plan is to sustain abundant waterfowl populations by conserving landscapes, through partnerships, guided by sound science. The 2003 Update establishes a new 15-year horizon for waterfowl conservation in North America by assessing and defining the needs, priorities and strategic direction required to guide waterfowl conservation in the 21st century.

"The purpose of the Plan is to sustain abundant waterfowl populations by conserving landscapes, through partnerships, guided by sound science.

The following principles are the base for the 2003 Plan and should guide any actions undertaken in its support:

- Waterfowl are among North America's most highly valued natural resources.
- Waterfowl populations should be sustained at objective levels across their natural ranges to provide both ecological and socio-economic benefits.
- Protection of North American waterfowl populations and their habitats requires long-term planning and close cooperation and coordination of management activities in Canada, Mexico, the United States, and other countries important to North American waterfowl.
- Resident and endemic species are important components of each nation's North America's waterfowl heritage and deserve significant attention and resources from within the jurisdictions where they occur.
- Managed subsistence and sport harvests of the renewable waterfowl resource are desirable and consistent with its conservation.
- Joint ventures, partnerships among private organizations, individuals, and government agencies, are the primary vehicle for accomplishing Plan objectives.
- Long-term protection, restoration, and management of waterfowl habitats requires that Plan partners collaborate with other conservation and community efforts in the development of conservation, economic, and social policies and programs that sustain the ecological health of landscapes.
- Plan implementation is founded on sound science and guided by biologically-based planning, both of which are, in turn, refined with increased knowledge gained through evaluation and research.

An Evolving Conservation Strategy

Since 1986, Plan partners have devoted billions of dollars to conserving waterfowl. Many millions of acres throughout North America have been secured, protected, restored or otherwise enhanced, and important advancements in waterfowl science have been made.

The essence of the original Plan was ambitious and innovative: waterfowl populations could only recover through habitat conservation at a continental scale. Previously, waterfowl habitat projects were targeted at individual wetlands or wetland complexes with the hope that their cumulative effects would positively influence duck populations. The 1986 Plan recognized that wide-ranging degradations to wetlands and their associated uplands required a comprehensive response. That comprehensive response focused on landscapes and utilized public policies, agricultural programs, and partnership development, as well as traditional habitat conservation programs.

The Plan identified general objectives for habitat conservation in five key priority regions, with the acknowledgment that each region would convert the objectives into local action plans. Joint ventures were formed to prepare and implement action plans. Elaborating on the original habitat protection goals, these plans included habitat protection, restoration, enhancement, and management. They were based on assumptions of waterfowl limiting factors in specific landscapes. By evaluating these assumptions and the management actions designed to address them, scientists continued to learn about interactions between waterfowl and habitat. Through increased recognition of the benefits of sustainability and a landscape approach – including the necessity to work with diverse

Joint Ventures, A key Plan element

The first Joint Ventures (JVs) were formed following the signing of the North American Waterfowl Management Plan in 1986 as a means for governments and private organizations to cooperate in the planning, funding and implementation of waterfowl conservation projects. The first habitat JVs quickly developed "flagship" projects in the high priority landscapes identified in the Plan, while two species JVs were formed to address gaps in the scientific understanding needed to develop effective management strategies for black ducks and Arctic-nesting geese. Over time, additional JVs were organized by partners to address other habitat and population concerns identified in the Plan and its Updates.

By 2003, JVs had exceeded original expectations in number, scope, and funding leveraged for conservation action. Today's JVs are regional-scale, self-directed partnerships involving federal, state, provincial, and local government agencies, tribes, corporations, individuals, and a wide range of private groups and organizations. JVs are successful models for planning and delivering cooperative, science-based, on-the-ground projects to conserve habitat for waterfowl and other fish and wildlife. Two key facets for continuing the JVs' conservation success are a commitment to a strong biological foundation, continually improved through an adaptive approach to management, and the development of effective regional partnerships that coordinate delivery of conservation resources on mutually accepted objectives.

The JV habitat objectives in 1986 were based on the Plan's population objectives and simple assumptions of how habitat quantity, quality, and distribution affect continental waterfowl populations. Since then, JVs have accepted the responsibility for evaluating these assumptions through the response of waterfowl to habitat changes at regional scales. Much has been learned from these evaluations, improving both our biological foundation and the strategies and mechanics of JV conservation programs. This adaptive approach ensures that JVs are both biologically effective and cost-efficient. In the future, JVs must continue to improve their understanding of these regional-scale relationships by clearly stating their biological assumptions, setting quantifiable conservation objectives, and establishing vigorous monitoring and evaluation programs

The original impetus for JV partnerships was the recognition that no single agency or organization could afford the Plan's anticipated costs. Indeed, the proven ability of JVs to leverage funding from multiple sources is a prominent asset. However, the greatest strengths and achievements of JVs stem from their partnership structures and non-regulatory, cooperative approach to natural resource management. JVs embrace the diverse values of their members, focus attention on communally defined goals, and provide a forum for the constructive resolution of potential natural resource management conflicts.

stakeholders –Plan partners have integrated waterfowl conservation into broader conservation contexts and other social needs.

The original Plan invented the concept of mobilizing cooperative partnerships under a set of continental objectives. This vision has been realized, as evidenced by the stable, diverse, highly productive, and growing number of joint ventures. Each joint venture is a unique collection of partners, reflecting local and regional interests. While most joint ventures focus on habitat concerns, Plan partners recognize that a significant lack of biological information limits management of some species. To address these gaps, species joint ventures are formed where a coalition of partners emerge with the resources, capabilities, and expertise to carry out necessary research and monitoring..

Cumulative Joint Venture Habitat Accomplishments - 1986-2002

Joint Venture	Acres	Dollars ($US)
Atlantic Coast	1,261,908	360,036,000
Central Valley Habitat	575,192	248,831,000
Eastern Habitat	758,194	113,350,000
Gulf Coast	1,086,891	205,328,000
Intermountain West	163,991	14,819,000
Lower Mississippi Valley	1,018,749	204,945,000
Pacific Coast	448,000	498,000,000
Playa Lakes	105,942	50,425,399
Prairie Habitat	2,129,967	285,791,000
Prairie Pothole	1,784,759	214,762,000
Rainwater Basin	24,611	5,934,000
San Francisco Bay	12,701	
Upper Miss./Great Lakes	492,227	123,382,783
TOTAL:	9,863,132	2,325,604,182

The 1986 Plan established a clear demarcation between its advisory role in waterfowl conservation on the one hand, and the role of existing regulatory authorities and the functions of the Flyway Councils on the other. All, however, rely on sound science and an adaptive approach to management. Waterfowl surveys, banding studies, species working groups, and other efforts sponsored by Flyway Councils have greatly contributed to the knowledge of waterfowl biology and population dynamics. The NAWMP Science Support Team (NSST) was formed in 2000 to create a partnership with the joint ventures and the Flyway Councils for improving the Plan's biological foundation. Further development and strengthening of this partnership will be essential for the Plan's future success.

Stimulated in part by the 1994 and 1998 Updates, regional partnerships are striving towards "integrated bird conservation", that is, strategic conservation that considers the habitat requirements of all bird species based on spatially explicit, biologically-driven, regional-scale conservation plans. The planning process uses biological models that relate priority species to their habitats and to identify the management actions necessary to support stated population objectives. A model-based, spatially-explicit process may be the only way to effectively plan for integrated avian conservation at regional or focus-area scales because it:

- Accommodates heterogeneity in habitat potential across regions and landscapes;
- Integrates the best biological information to assess the potential of each acre of the landscape;
- Identifies priority landscapes where single species or groups of species will benefit most from management actions;

- Explicitly targets areas where management can significantly impact multiple species or groups, and provides a basis for selecting among conflicting management options in these areas; and
- Provides for the strategic refinement of the biological foundation monitoring, assessment and directed research.

Plan successes have hinged on the ability of diverse interests to create and sustain relationships flexible enough to invent improved approaches to conserving waterfowl. These partnerships are the Plan's living legacy and may be the Plan's most important contribution to natural resources conservation. Plan partners have expanded beyond waterfowl and other wildlife interests to include soil and water conservationists, land and water resource development interests, and, most importantly, local communities and private landowners.

Institutional Relationships

The Plan is a cooperative international endeavor involving governments at all levels, non-government organizations, corporations, and individuals. The Plan leads by providing a compelling blueprint for action and empowering partners to work within that scientific and organizational framework. The Plan's continentally oriented, but locally controlled model is designed to ensure that collective waterfowl conservation impacts exceed the sum of the accomplishments of its individual partners. Individual partners, in turn, contribute effectively by uniting in support of the Plan's scientific basis and an understanding of each player's roles and responsibilities. The Plan has thrived under the local entrepreneurship that this model has unleashed, evolving into a highly effective alliance of diverse agencies, authorities, organizations, and interests. Its "business model" has been adopted by other continental bird initiatives, such as Partners in Flight and the U.S. Shorebird Conservation Plan. The Plan may be thought of as a nested system, which facilitates both internal and external networks.

'The Plan's continentally-oriented but locally controlled model is designed to ensure that collective waterfowl conservation impacts exceed the sum of the accomplishments of its individual partners."

Externally, the Plan operates within each country's laws and regulations, consistent with international treaties and agreements. Government wildlife officials have the authority and responsibility to ensure Plan actions are in compliance with applicable laws, regulations, and policies. The Plan also seeks opportunities to work through other large-scale conservation initiatives such as the Convention on Wetlands of International Importance (Ramsar), the Western Hemisphere Shorebird Reserve Network, and U.S. Farm Bill conservation programs. The Plan Committee maintains close ties with the four Flyway Councils, the North American Wetlands Conservation Council, the International Association of Fish and Wildlife Agencies, and the North American Bird Conservation Initiative through close communication and concurrent memberships,. Individual joint ventures enlist other groups and land management players as reciprocal partners where appropriate to local conservation strategies and opportunities.

Federal, state, provincial, and territorial wildlife agencies, regional committees, and the four Flyway Councils work closely in managing the sport harvest of waterfowl. Demographic models developed by the NAWMP Science Support Team (NSST) to inform Plan decision-making incorporate harvest levels projected by those agencies. NSST analysis is also shared with wildlife agencies and Flyway Councils to ensure that the best possible science is brought to bear on harvest management decisions.

Internally, the Plan Committee provides oversight of the Plan, scientific learning is documented and shared continentally by the NSST, and implementation is lead by the joint ventures . The Plan Committee has no authority to dictate actions to joint ventures and other partners. It fosters cooperation and synergy through active leadership, lucid guidance, and meaningful assessments of waterfowl conservation actions conducted under the aegis of the Plan. Plan structures are described in greater detail in Appendix C.

A More Proactive Plan Committee

Historically, the Plan Committee has shaped the course of North American waterfowl management efforts through the objectives and recommendations included in the Plan updates, and the Committee's role in endorsing joint ventures. Conservation has flourished under this level of engagement. However, the growth of the joint ventures, the increased availability and diversification of funding sources, the need for improved biological planning and assessment, and dynamic socio-economic trends, all point to the need for a Plan Committee that provides active leadership 365 days a year – not just during the 5-year Plan updates. There is also a growing consensus that the Plan Committee needs to move beyond articulating vision to play a much more active role in promoting improved management on the ground.

With this document the Plan Committee supplements its leadership activities by providing regional geographic species priorities to help guide future conservation investments (detailed in Appendix B) and commits to undertaking the following, on a continual basis:

- Serving as a forum for important waterfowl issues
- Influencing appropriate government agencies to support Plan needs, as articulated by joint ventures and the NSST
- Integrating science into targeted waterfowl-related policy debates
- Improving linkages with joint ventures, the Science Support Team, Flyway Councils, and the North American Wetlands Conservation Council.

The Plan Committee will also be more directly involved in supporting enhancement of the effectiveness of Plan partners through:

- Conducting a comprehensive assessment of progress toward Plan goals and objectives in 2004-2005
- Preparing periodic reports on the status of Plan implementation for the 3 federal wildlife agencies using input from the joint ventures and the NSST.
- Providing specific recommendations to government agencies, flyway councils, wetland councils, and other bodies to further the implementation of the Plan.

Finally, the Committee will:

- Review periodically the Plan Committee's own effectiveness and consider structural, relational, and management approaches to enhance Committee impact.
- Annually solicit joint venture and other Plan partner input on the status of Plan implementation and issues to be addressed by the Plan Committee.

III. Waterfowl Conservation in a Changing World

Waterfowl have long been the centerpiece for migratory bird conservation in North America. Their status as highly sought-after gamebirds led to many of North America's greatest conservation successes, such as the 1916 Migratory Bird Treaty, the Migratory Bird Hunting Stamp Act of 1934, and the North American Wetland Conservation Act of 1989. The active commitment of hunters to conservation spurred legislation to protect waterfowl from the effects of habitat destruction and unregulated harvest as well as, later, to restore lost habitats.

To effectively prepare for the future, Plan partners must be cognizant of ecological and societal trends that significantly affect our ability to manage waterfowl habitats and populations. These trends also influence the potential to involve new conservation partners, and the ability of agencies and governments to focus resources on waterfowl conservation. Managers need to ensure that the Plan remains relevant to the broadest possible segment of society and to both policy- and decision-makers.

Waterfowl Uses and Values

From the beginning, Plan authors and managers have considered the range of consumptive waterfowl uses -- chiefly subsistence and recreational hunting -- and non-consumptive benefits such as photography and viewing. Hunting remains an important part of the cultural fabric of North America. Subsistence waterfowl harvest - although a small proportion of the continental waterfowl harvest - is also important, nutritionally and culturally, in parts of Canada and Alaska. In addition, commercial or subsistence harvest may be significant for individual waterfowl populations, e.g the eider harvest in Greenland.

Recreational hunting accounts for the vast majority of waterfowl harvest and remains tremendously important at national, regional, and local levels. There have been short-term fluctuations in waterfowl hunter numbers, from a high of approximately 2.8 million in 1970 to a low of 1.56 million in 1992, with over 1.84 million waterfowl hunters in the U.S. and Canada in 2001, 18% higher than in 1992. Regional trends have varied; migratory bird hunting permits in Canada have steadily declined to only 181,000 in 2001 from a peak of nearly 525,000 in 1978, a 72% decrease. On the other hand, U.S. waterfowl hunter numbers in 2001 (1.66 million), were 30% higher than in 1992 (1.28 million). In Mexico, a long standing tradition of waterfowl hunting by mostly local groups has changed over the last 30 years. The development of waterfowl hunting services has increased, focusing on the international tourism market, primarily U.S. hunters. Today, foreign hunters make up almost 80% of the participants of this activity in Mexico, producing an estimated $10 million US in annual economic benefits. Fluctuations in hunter numbers correlate to some degree with waterfowl populations, the long term decline in waterfowl hunters is more likely related to demographic, socioeconomic, and cultural trends.

Hunters are long-standing supporters of conservation and contribute substantial resources for waterfowl habitat conservation. They have traditionally been the primary supporters of the Plan's mission and remain committed partners. Sale of Federal duck stamps in the U.S. generated $25 million for the purchase of wetland habitat in 2001 The economic impact of waterfowl hunting is significant and continues to grow. In the U.S., almost 3 million migratory bird hunters, including 1.66 million duck hunters, expended approximately $1.4 billion in 2001.In Canada, hunters have contributed $335 million and 14 million hours of volunteer work to habitat conservation over the past 15 years.

"Mechanisms must be developed to allow those involved in waterfowl viewing to more directly and effectively contribute to waterfowl habitat conservation."

The number of people active in other forms of related outdoor recreation, such as waterfowl viewing, continues to grow. 14.4 million people participated in watching waterfowl in 2001. This group clearly benefits from robust waterfowl populations and represents a largely untapped resource for Plan activities. If conservation efforts are going to grow over time, the associated costs must be distributed across society. Mechanisms must be developed to allow those involved in waterfowl viewing to more directly and effectively contribute to waterfowl habitat conservation.

Waterfowl in a Complex Environmental Agenda, Challenges and Opportunities

The array of wildlife and environmental issues continues to expand. There are now conservation initiatives associated with species-groups as diverse as bats, butterflies, amphibians and reptiles. In general, however, the resources and staffing levels currently available to conservation agencies have not grown in proportion to the new demands, and in many cases have even declined. The increasing public awareness is overwhelming many of these agencies' capabilities.

Clearly, greater efficiencies, broader partnerships, and increased financial and human resources will be essential to meet the growing demands of the environmental agenda. The Plan community must continue not only to capitalize upon opportunities for greater communication and cooperation, but to proactively create them. Efforts such as the North American Bird Conservation Initiative present such opportunities, and Plan partners have been among the leaders of this emerging context. While initial progress with new partnerships might require significant effort, the potential for long-term benefit is great. The increased breadth and potential strength of these relationships carry the promise of expanding the resources for waterfowl conservation.

The socioeconomic and environmental contexts of waterfowl conservation have changed in many ways since 1986. Change will continue as a result of driving forces such as human population growth; growing societal demands for water, energy, food, and fiber; and urban expansion. The Plan functions in a context of continued wetland loss and degradation, increased problems with invasive species, increased levels of atmospheric greenhouse gases, and increased pressure on the landscape to meet the always competing and often conflicting demands of society.

Despite the natural tendency to focus on the negative consequences of change, novel conservation opportunities will also arise. For example, shared concerns over adequate supplies of clean water have already lead to synergies between Plan partners and local governments, highlighting the potential for Plan activities to provide multiple benefits to society. The extent to which Plan partners are able to respond creatively to challenges such as human population growth or climate change will be critical to future success.

Although not an all-inclusive list, the following categories of broad socioeconomic forces include important examples of driving trends that are most relevant to the future of waterfowl conservation. They are areas which have seen significant changes since the 1970's, i.e., the baseline period for the Plan's initial objectives. These brief reviews are intended to highlight the types of issues that Plan partners must monitor to manage waterfowl successfully into the future.

Continuing Human Population Growth and Urban Expansion

Continued human population growth is ultimately the driving force behind many of other issues. The world's population grew from 3.7 billion in 1970, to 5.9 billion in 1998, and is projected to reach 9.1 billion by 2050. In North America, the population was 42% higher in 1998 than in 1970, and by 2050 it is projected to increase over 50% from the current level.

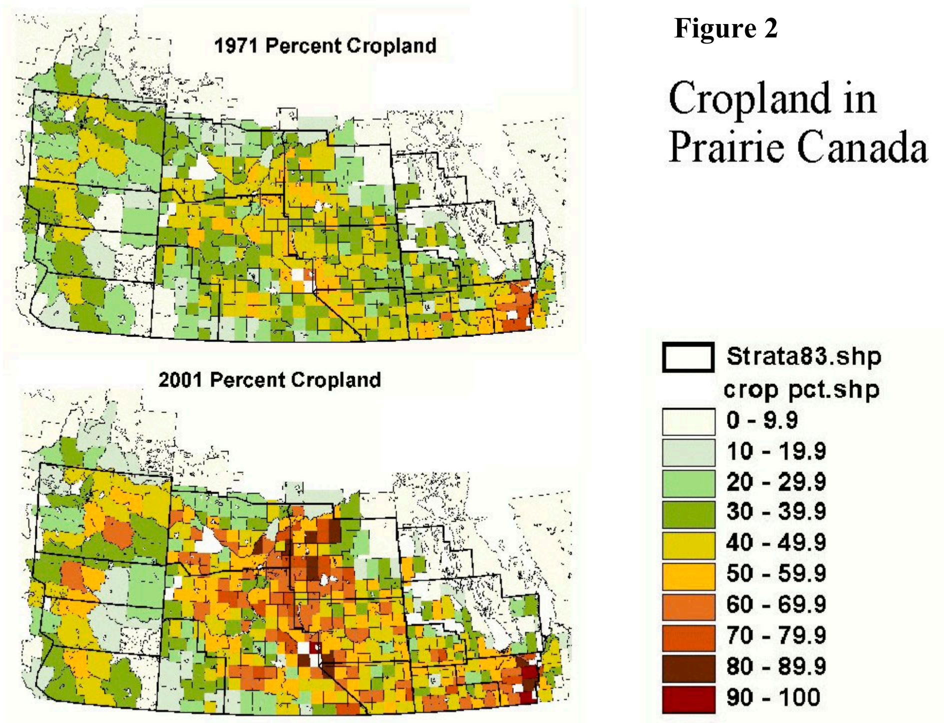
This population growth adds enormous pressures to the landscape, with significant ramifications for waterfowl conservation. For example, along our coasts where nearly half the U.S. population resides, the U.S. qualifies as one of the most densely populated countries in the world. In the Northeast, the average population density is 767 people per square mile. By 2010, the population density in the coastal parts of California will reach 1,050 people per square mile. The associated sprawl is already resulting in significant pressures on waterfowl, e.g., observed declines in the habitat and waterfowl use of Chesapeake Bay. An awareness and assessment of where population growth will occur and its likely impacts will be imperative to effectively secure those areas most important to waterfowl's future.

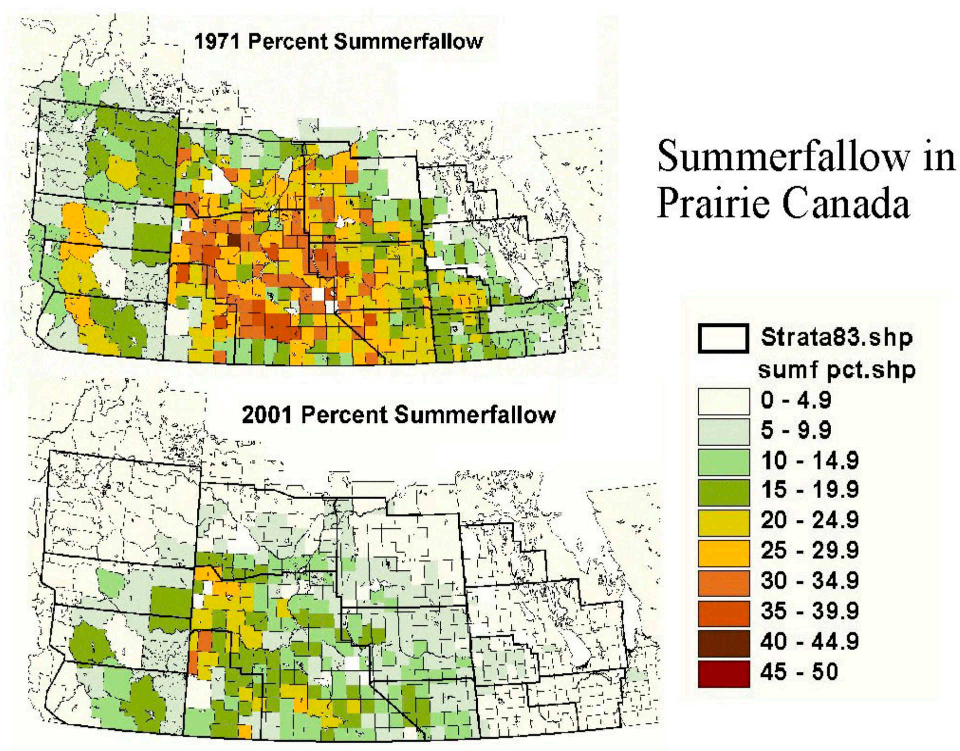
In addition, as the North American population continues to increase and shift from farms and rural environments to cities and suburban centers, there is likely to be an erosion of the public's understanding of conservation issues. This could ultimately manifest in reduced legislative support for Plan objectives. The Plan's future relevance will depend upon strategic efforts to work within the context of these inevitable societal changes. For example, as natural habitats become scarcer, their relative values to society increase. Plan partners will need to engage a broader audience to achieve waterfowl conservation goals.

Demands for Food and Fiber

With human population increase comes increased demand for food and fiber, with attendant expectations for agriculture, aquaculture and forestry. For example, Figure x depicts the significant increase of cropland in the southern portions of the Canadian prairie provinces. This trend has primarily been driven by the drastic reduction in summerfallow (Figure y), which has in turn been driven by other agricultural policy forces. Many waterfowl scientists now believe that one of the principal reasons for the decline of pintail populations, and their lack of positive response during the 1990's, was this loss of grassland and summerfallow nesting habitat.

Figure 2





On the positive side, habitat gains resulting from conservation titles within U.S. farm bills have been enormous and illustrate the waterfowl benefits that can be achieved by proactively responding to these challenges and transforming them into opportunities for success. For example, as of February 2003 the Conservation Reserve Program had enrolled 11.75 million acres in the prairie pothole states of North and South Dakota, Minnesota, Montana and Iowa. Much of this acreage involved establishment of grassland which provides important waterfowl nesting habitat. Farm legislation also implemented the Wetland Reserve Program, which has restored over 1.25 million acres of wetlands and associated habitats. More than 400,000 of those acres are in the Mississippi Alluvial Valley, one of the most important waterfowl wintering areas on the continent. Neither of these important programs existed when the original Plan was authored, illustrating the enormous reach of agricultural policy and the extent to which it can alter landscapes that support waterfowl populations.

Continued involvement by waterfowlers and other conservation interests will be necessary to uphold these gains, many of which derive from programs with limited time frames. International trade agreements and environmental accords such as the North American Free Trade Agreement will continue to influence global market forces in ways that will, in turn, affect intensity and patterns of agricultural practices. Other changes in land use patterns, such as the expansion of aquaculture along both coasts of the northern U.S. and Canada and in the mangrove swamps of Mexico, can detrimentally affect waterfowl habitat and populations.

Similarly, the introduction of more intensive forestry into new regions, such as the western boreal forest of Canada, may bring new pressures on habitats that have long been thought relatively secure. The western boreal forest is the second-most important region on the continent to breeding ducks, and expanding forestry and agriculture are rapidly having major impacts on this forest ecosystem.

Plan partners must strive to anticipate the trajectory and effects of these kinds of trends and seize opportunities to influence agricultural and other policy to enhance waterfowl benefits and minimize negative impacts.

Demands on Wetlands and Water Systems

Society's growing demands for water are reducing waterfowl habitats. U.S. demands for freshwater increased by approximately 42% from 1960 to 1995. In areas of high profile water battles, allocation of water resources has long required significant compromise, and many of these areas are critically important for waterfowl conservation. Nowhere is this more evident and important than in the Central Valley of California where the needs of sharply rising human populations are already colliding with agricultural and wildlife needs. Water shortages are also now appearing in areas previously considered to have abundant resources. For example, despite approximately 50 inches of annual rainfall, it is predicted that parts of eastern Arkansas will exhaust their groundwater supplies by 2015. This has resulted in proposals for diverting significant amounts of surface water to irrigation, with a potential impact on thousands of acres of wetland habitats.

Effective conservation of wetland and waterfowl habitat can provide society with vital ecological services, such as water quality improvement and flood control. For example, the agricultural community and waterfowl interests have worked together in the California's Central Valley to provide wintering waterfowl habitat while contributing to the weed control and clean air objectives of farmers and other citizens. The city of Boston is acquiring 5,000 acres of wetlands in the Charles River watershed in order to avoid the necessity of constructing a $100 million flood control structure. New York City has initiated a $250 million program to acquire and protect up to 350,000 acres of wetlands and riparian lands to protect the quality of its water supply. The alternative was to construct water treatment plants at a cost of $6-8 billion.

Public opinion surveys have repeatedly documented that an overwhelming majority of the public places a very high priority on water and wetland issues. A recent national survey in the U.S. documented that the number of citizens who believed there were too few wetlands was 15 times greater than the number who thought there were too many. This provides a significant opportunity for the Plan community. With ample lead time and strategic planning, management actions can provide the broader benefits desired by the public and simultaneously generate significant non-traditional support for Plan objectives.

Conservation efforts related to waterfowl are in many cases inextricably linked to other important uses of water and wetlands in coastal areas. In many coastal areas, agriculture, aquaculture and tourism development threaten coastal areas particularly mangrove swamps and inshore reefs. Education about, and conservation of, such fragile ecosystems not only provides critical waterfowl habitat but also aids in stabilizing rural economies based on fish, shellfish, and ecotourism activity important to the local economy.

Energy Demand and Use

With a burgeoning human population, North America's demands for energy will continue to grow. There are significant relationships between waterfowl habitats and all aspects of energy production and use, and these relationships must be considered as managers plan for the future.. Initial exploration for energy resources can significantly impact important habitats, as, for example, in the western boreal forest of Canada.

In the case of water development, the operation of existing facilities and the development of new ones can change river flow patterns in ways that negatively affect associated wetland habitats, drying out some and inundating others. For example, dams on the upper White River in Arkansas and Missouri were constructed decades ago to alleviate flooding in the lower river. In doing so, these dams have also reduced the winter hydroperiod in the forested Wetlands of International Importance along the lower White, the most important mallard wintering region on the continent. A recent cooperative study has generated discussion about possible management actions. An environmentally sensitive modification of dam operations could adjust the annual hydrograph to more closely resemble the natural one, thereby potentially benefiting both waterfowl and irrigation interests.

The conversion of fossil fuels to energy adds carbon dioxide and other greenhouse gases to the atmosphere. There is now scientific consensus that global climate change is occurring, although debate continues regarding the extent to which these gases and energy use contribute to this change. Research cited in the U.N.'s Intergovernmental Panel on Climate Change[2] and the U.S. National Assessment of the Potential Consequences of Climate Variability and Change, has predicted changes to many of North America's most important waterfowl habitats. For example,

[2] Intergovernmental Panel on Climate Change. 2001a. Summary for Policymakers, Working Group I, Third Assessment Report. [online] URL:http://www.ipcc.ch/pub/spm22-01.pdf.

warming and increased soil moisture deficits are predicted for the mid-continent prairie pothole region, with the likelihood of significant decreases in average wetland abundance by the 2080s. Sea-level rise due to thermal expansion of the oceans and melting of land ice will most likely continue and could result in accelerated loss of important waterfowl habitats along the Gulf and Atlantic coasts. Louisiana, with 40% of the coastal marshes in the continental U.S., loses the equivalent of a football field of wetlands every day to land subsidence and rising water levels. This could have significant implications for species such as scaup and pintail. Relative sea-level rise, a product of rising oceans and changing land levels, is most severe along the Gulf and Atlantic coasts and some Arctic areas. In general, the problem is less along the Pacific Coast, except in heavily developed estuaries like San Francisco Bay where in-shore migration of wetlands will be severely limited. In places like Chesapeake Bay benthic anoxia may worsen, affecting important diving duck food resources, but this outcome will be affected by patterns of precipitation in the watershed, something that varies among competing climate models. Among the regions expected to be most affected by climate change, the western boreal forest is predicted to have warmer and dryer conditions, which could result in widespread habitat changes associated range shifts of plants and animals and melting of permafrost with subsequent land subsidence. We cannot anticipate with confidence what effects ecological changes in the breeding range of sea ducks may have, but this requires better monitoring as many sea duck populations are already in decline. For arctic-nesting white geese, where over-abundance and associated habitat degradation are concerns, warmer springs could enhance breeding success and work against efforts to control these populations. On the other hand, other goose and swan species may benefit.

Although some uncertainty remains as to the extent and nature of the coming changes, Plan partners must begin considering these factors. As climate change models improve and uncertainties diminish, these issues should increasingly be an explicit component of long-term planning and implementation.

Finally, the Plan community should be aware of developments and contribute to the science of climate impact assessment in order to generate a broader awareness of their significance, particularly with respect to waterfowl, wetlands and related issues. Initial responses to climate change by government and industry have already presented Plan partners with significant conservation opportunities. For example, the restoration of forested wetland and grassland habitats, as well as the commodity trading of "carbon credits" produced within these ecosystems, are currently in place. Some maintain that this sort of carbon sequestration could ultimately rival the U.S. farm bill in the magnitude of its impacts. This strategy has significant positive implications in critical waterfowl habitats such as the prairie potholes and lower Mississippi valley. The involvement of the waterfowl management community in the initial development of this strategy has already led to carbon sequestration projects explicitly designed to provide waterfowl habitat benefits. Furthermore, Plan partners are influencing the broader discussion in ways that could help lay a long-term framework which would generate significant benefits for waterfowl habitats.

Contaminants, Invasive Species and Disease Concerns

Disease mortality is a chronic concern of waterfowl managers, particularly in areas where molting, migrating, and wintering birds congregate. For most widespread waterfowl populations numbering in the hundreds of thousands to millions, disease outbreaks alone are unlikely to affect continental population status. However, diseases such as avian botulism , cholera or duck viral enteritis may exacerbate population declines, affect human use, and place significant burdens in terms of personnel, equipment, and money on responding agencies. Recent experiments in Prairie Canada showed that on large shallow lakes, traditional carcass clean-up in response to botulism outbreaks was ineffective for reducing duck mortality. Researchers continue to seek other methods for managing this serious disease.

Multiple uses of remaining water sources and wetlands may degrade habitat quality in ways that have detrimental effects on waterfowl health. Agricultural and urban runoff and sewage effluent carry heavy metals, industrial compounds, pesticides, and pharmaceuticals, the effects of which are not fully understood. Such contaminants may result in direct losses and reductions in productivity, and contribute to increase susceptibility to disease. With continued agricultural and urban expansion, influxes of chemicals are not likely to abate.

Exotics Linked to Waterfowl Disease

Introduction of non-native species of birds, fish, invertebrates, and mammals may be accompanied by simultaneous introductions of invasive pathogens. Botulism type E, which is associated with fish, and has caused both human and bird mortality, is an emerging disease problem in the Great Lakes. Although documented since the 1960s, mortality was relatively low and sporadic until 1998. Since that year, annual outbreaks have occurred in fish- and mollusk-eating birds in Lakes Huron and Erie. In 2002, estimated losses of long-tail ducks exceeded 12,000 birds in New York Lake Erie waters alone, with additional losses along Canada's shores. Many dead birds had ingested round gobies or dreisseneid mussels, which are introduced species. Although the mussels have been in the lakes for a number of years, the round goby is a recent introduction. There appear to be correlations between the spread of the goby through the Great Lakes and the locations of botulism type E outbreaks, and research is underway to better understand the relationship. While small wetlands and ponds can be made unattractive to waterfowl, or managed to provide unfavorable conditions for toxin production, the options on Lake Erie and the other Great Lakes are more limited. The introduction of these non-native species may have set the scene for large-scale losses for many years to come.

An emerging threat to many bird species is West Nile virus (WNV). WNV has spread across the North American continent with remarkable speed since its emergence in New York in 1999. Although the virus has been identified in a number of waterfowl species, it is still uncertain to what extent WNV poses a threat to North American waterfowl populations. In the first 3 years after the disease was reported in North American, bird mortality was concentrated on Corvids (crows and jays). Beginning in 2002, significant mortality was recorded in hawks and owls from the Upper Midwest to Louisiana. This corresponded to a dramatic rise in the number of human cases and deaths from WNV. WNV has undergone a number of genetic mutations since its arrival in North America in 1999, and this can be expected to continue. One or more future mutations could make the virus more virulent to ducks, geese, and swans. Monitoring of waterfowl populations for future impacts of WNV is warranted.

Unfortunately, in response to human health concerns, there has been growing demand to eliminate breeding habitat for mosquitoes, especially near urban centers. This poses an immediate threat to waterfowl habitat. Plan partners should keep abreast of research on the ecology of West Nile virus and it's hosts, and help inform public discussions about management options.

Change is inevitable. The context for waterfowl management has altered over the Plan's first 17 years and it will continue to change. Success in achieving Plan objectives will ultimately depend upon our ability to work with an awareness of these trends and an understanding of their potential impacts. The challenge is to respond creatively to the opportunities that change represents.

IV. Waterfowl Population Objectives and Status

North America has forty-eight species of ducks, geese, and swans, most of which depend on habitats in two or more countries to complete their life cycles. Forty-two species are shared among North American and other countries. Two southern species, the masked duck and muscovy duck, are shared between Mexico and Latin American and Caribbean nations; the emperor goose is shared between the United States and Russia;. and various sea duck species move between Alaska, Russia, arctic Canada and Greenland during breeding and nonbreeding seasons. An additional three species are non-migratory endemics of the Hawaiian archipelago. Population objectives have been established for many species, races and populations of waterfowl. Because many waterfowl rely on dynamic habitats, Plan population objectives reflect average population sizes corresponding to a range of environmental conditions.

"Population objectives move the Plan beyond a mere concept for wetland conservation by grounding it in the explicit terms of species conservation."

Purpose of Population Objectives

Plan waterfowl population objectives serve three important functions related to communications, planning, and evaluation. First, population objectives move the Plan beyond a mere concept for wetland conservation by grounding it in the explicit terms of species conservation. This makes it easier to communicate and promote Plan priorities to legislators, administrators, partners, and the public. Second, explicit population objectives provide a framework for organizing cohesive regional planning efforts and for gauging their success. Third, comparison of population objectives with monitoring data provides an objective assessment of the status of North American waterfowl.

"Waterfowl objectives provide a framework for organizing cohesive regional planning efforts and gauging their success."

At large geographic scales, the effect of natural environmental variation complicates the assessment of Plan impacts. . There are also difficulties in unambiguously attributing habitat changes to Plan and non-Plan activities. Nevertheless, substantial, sustained declines from the Plans' population objectives should be cause for concern and may indicate that habitat change has affected the capability of landscapes to meet waterfowl needs.

Characteristics of Population Objectives

The Plan's population objectives are intended to be simple and easy to communicate. They are reviewed for consistency with other North American waterfowl management objectives, such as those developed by the Flyway Councils. . Finally, all Plan population objectives are quantitative and can be compared to the results of operational monitoring programs.

"Waterfowl harvest management and habitat conservation … should be guided by complementary objectives that are consistent with long-term population viability and with human utilization of the waterfowl resource."

Some waterfowl exhibit large population fluctuations in response to natural environmental variation. In such instances, it is difficult to compare annual estimates derived from monitoring programs directly with population goals. This is because Plan goals reflect average population size associated with a range of environmental conditions. To provide more meaningful comparisons, the NSST is investigating historical and contemporary relationships between waterfowl populations and uncontrollable natural environmental variation. Initial efforts have been directed towards several species whose populations fluctuate naturally in response to dynamic wetland conditions in the prairie-parkland region of the United States and Canada. The NSST will continue this work to provide a more meaningful basis for assessment of population status.

General Principles related to Objectives

A general objective of the Plan since its inception in 1986 has been to maintain or restore traditional distributions of waterfowl in North America, consistent with long-standing patterns of waterfowl utilization. It is recognized, however, that broad-scale land cover and agricultural changes have resulted in changes in the distributions of some waterfowl in recent decades, and that many of these factors are largely outside the control of waterfowl managers.

"The Plan seeks to maintain or restore traditional distributions of waterfowl in North America, consistent with long-standing patterns of waterfowl utilization."

It is also recognized that managed harvest of waterfowl is desirable and consistent with conservation. Waterfowl harvest management and habitat conservation are nterrelated pursuits, and their success is mutually reinforcing. Thus, they should be guided by complementary objectives consistent with long-term population viability and with human use of the waterfowl resource. Adaptive Harvest Management, now being pursued in the management of several duck populations, offers many options for explicitly linking harvest and habitat management efforts under the Plan. Many more options exist and will be explored in the future.

Definitions

To reduce ambiguity in discussion of population status and objectives, several frequently used terms are defined for the purposes of this Plan.

Population: a non-specific term which, depending on the context, refers to a group of birds of one or more species (e.g., the North American scaup population refers to the continental population of both greater and lesser scaup) and/or races distinguished for management or conservation purposes. Management does not necessarily imply harvest management and may refer solely to habitat conservation planning and implementation.

The term population is sometimes used to refer to a sub-segment of a continental population (i.e., sub-population). Sub-populations described in this Plan may be allopatric or sympatric. In the case of ducks, only allopatric sub-populations within a species are recognized (Tables 1 and 2) since these population segments may be exposed to widely divergent sets of factors affecting abundance. Geese and swans exhibit strong philopatry to breeding, wintering, and migratory routes and thus it is common for population segments to be exposed to differing risks. For this reason, numerous populations (i.e., sub-populations) may be identified for a particular species (Tables 3 and 4). These populations may be completely allopatric or sympatric at certain times during the year.

Race: refers to a taxonomically distinct sub-species[3].

Duck Population Objectives

Breeding duck population objectives are derived from average breeding population levels of the 1970's or species-specific management plans (Table 1). The decade of the 1970's is representative of a range of environmental conditions in the prairie-parkland region. Duck populations during this decade were generally thought to meet the demands of both consumptive and non-consumptive users. Of the 14 species, species groups, or races for which goals have been established, 11 have stable or increasing long-term trends in abundance.

Status of Dabbling Ducks, Perching Ducks, and Whistling Ducks

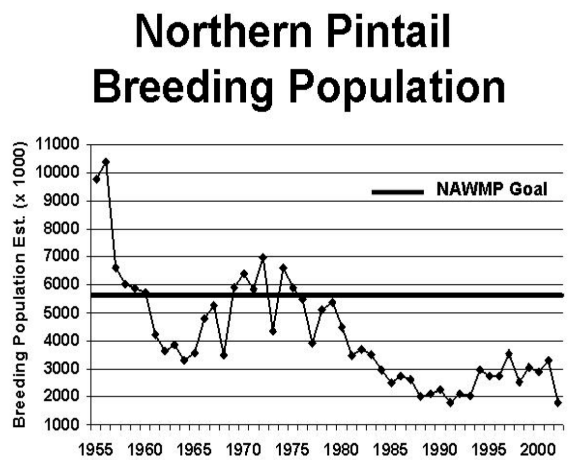
Dabbling ducks are the most abundant and widespread group of ducks in North America and are of the most importance to hunting and viewing. They include the mallard, American black duck, mottled duck, Mexican duck, American wigeon, northern pintail, gadwall, green-winged teal, blue-winged teal, cinnamon teal, northern shoveler, Hawaiian duck, and the Laysan duck. North American perching ducks include the wood duck and muscovy duck. Two species of whistling ducks, black-bellied and fulvous, also breed in North America. Present status and long-term population trends are presented for all ducks in Table 2.

The highest breeding densities of dabbling ducks are found on the prairies. Boreal habitats also support large populations at generally lower densities, although some regions in Alaska support breeding densities comparable to those of the Prairie Pothole Region. Losses of upland nesting habitat on the prairies particularly affect early nesting species such as mallards and northern pintails. Intensive agricultural land use on the prairie breeding grounds, combined with a sustained drought that began in 1980, adversely affected large segments of breeding habitat into the early 1990s. Abundant precipitation returned to the prairies in the early 1990s, and wetland

[3] Information of the taxonomy of North American waterfowl can be found in Appendix E

conditions remained good through 2001, particularly in the United States portion of the pothole region. Wetland conditions in the Canadian prairies were more variable during this time period.

Many dabbling and diving ducks breeding in the prairie pothole region exhibited population growth through the 1990s, particularly in the United States. There, abundant wet basins combined with large tracts of nesting cover (provided through the Conservation Reserve Program and Plan habitat enhancements) resulted in excellent duck production. The populations of six species of dabblers that breed in the mid-continent region increased to high levels over those years. These included mallard, gadwall, American wigeon, green-winged teal, blue-winged teal, and northern shoveler. However, not all dabbling duck species that breed in the prairie pothole region responded to the improved habitat conditions. Northern pintails, which historically nested in highest densities in western portions of the Canadian prairies, exhibited no population growth during the 1990s. There is emerging evidence that pintails may be particularly sensitive to recent changes in agricultural cropping practices, especially in the Canadian prairies.



Research by Plan partners indicates that nest success and survival of nesting hens are critical factors affecting upland nesting mid-continent duck populations. In areas like the Prairie Pothole Region, agricultural intensification and the addition of features like rock piles, culverts, shelterbelts and abandoned buildings to the landscape have enhanced habitats for some species of predators. It is clear that landscape degradation and corresponding changes in predator communities are the ultimate causes of low nest success and hen survival. In carefully selected areas, some form of active predator management may be warranted.

The American black duck population in eastern North America has decreased over the last four decades. Annual winter surveys that were used to index the size of the black duck population reported an average of 491,000 birds during the 1960s, falling to 285,000 during the 1990s. Although black ducks have declined in both the Atlantic and Mississippi Flyways, the proportional decrease has been far greater in the Mississippi Flyway. Breeding waterfowl surveys initiated by the Black Duck Joint Venture in 1990 in eastern Canada indicate that the breeding black duck population has increased, particularly in the Maritime Provinces, but has shown declines in the western portions of its breeding range. Although the population of breeding black ducks has increased overall during the past decade, long-term threats to black duck abundance remain. These include habitat loss, interactions with mallards, and hunting mortality. To improve both harvest management and habitat conservation planning, the Black Duck Joint Venture will continue development of demographic models, research coordination, and monitoring. .

The wood duck breeds primarily in eastern North America although a small west coast population breeds from California to British Columbia. Once severely depressed as a result of habitat loss and over-harvest, the wood duck made a dramatic comeback during the twentieth century largely in response to harvest restrictions. It now comprises a large proportion of the waterfowl harvest in the Atlantic and Mississippi Flyways. This species generally inhabits areas with dense overhead cover making broad-scale aerial surveys impractical. However, ground-based point counts from the North American Breeding Bird Survey and harvest statistics suggest both short- and long-term population trends are increasing.

Table 1. Breeding population objectives, recent status, and long-term trends for ducks (1,000s of ducks).

Species/Species Group/Race	Objective[a]	Average Population Size (1993-2002)[b]	Long-term Trend (1970 – 2002)
Mallard	8,200	8,416	Stable
Northern pintail	5,600	2,765	Decreasing
American black duck	640[c]	381[c]	Decreasing[d]
Mottled duck, Florida Race[e]	9.4[f]	11[f]	Increasing[g]
Gadwall	1,500	2,884	Increasing
American wigeon	3,000	2,578	Stable
Green-winged teal	1,900	2,386	Increasing
Blue-winged and cinnamon teal	4,700	5,642	Stable
Northern shoveler	2,000	3,161	Increasing
Hawaiian Duck[e]	5,000	2,500[h]	Stable[h]
Laysan Duck[e]	10,500	300[h]	Stable[h]
Redhead	640	796	Stable
Canvasback	540	648	Stable
Lesser and greater scaup	6,300	4,051	Decreasing

[a]Duck objectives are based on the Waterfowl Breeding Population and Habitat Survey, Traditional Survey Area (WBPHS-TSA) strata 1-18,20-50,75-77 and represent average population estimates from 1970-1979, unless otherwise noted.

[b]Average population size estimates are for the WBPHS-TSA unless otherwise noted.

[c]The American black duck population objective was developed from the predictions of a model relating Mid-winter Waterfowl Survey counts to population estimates derived from the Breeding Waterfowl Plot Survey (BWPS) of Eastern Canada. The objective corresponds to that portion of the black duck breeding range sampled during the BWPS. The average population size presented for black ducks also is derived from the BWPS and is for the period 1993-2001. For management purposes, the black duck objective has been partitioned for 3 portions of the breeding range: eastern, central, and western. In the future, combined estimates from fixed-wing and helicopter surveys will be evaluated for monitoring and objective setting for this species.

[d]Based on Mid-winter Survey data.

[e] Not shared between two or more signatory nations. Management is the responsibility of that nation whose boundary coincides with the range of the species, sub-population, or race.

[f] The mottled duck, Florida Race objective corresponds to that portion of this race's breeding range sampled by the Florida Mottled Duck Survey (FMDS). The objective for the Florida Race of mottled ducks is based on average population size estimates from 1985-1989. Reported average population size is for the time period 1994-2000.

[g]1994-2000.

[h] Hawaiian species are monitored by the Annual Hawaiian Waterbird Survey. Mean population estimates correspond to the years 2001 – 2002.

Table 2. Breeding duck population estimates and trends in North America (1,000s of ducks).

	1993 – 2002 Mean Population Estimates[a]			
Species/Sub-Population/Race[b]	***Continental***	***Traditional Survey Area***[c]	***Other Survey Areas***[c]	***Long-Term Trend (1970– 2002)***
Mallard	13,000	8,416	3,361	Stable
Mexican duck[d]	56	Not Applicable	Not Applicable	Increasing[e]
Northern pintail	3,600	2,765	161	Decreasing
American black duck	910	34	381[f]	Decreasing[e]
Mottled duck	660	Not Applicable	11	Stable[e]
Florida race[d]	30	Not Applicable	11[g]	Increasing[g]
Western Gulf Coast race	630[h]	Not Applicable	Not Applicable	Stable[e]
Gadwall	3,900	2,884	449	Increasing
American wigeon	3,100	2,578	383	Stable
Green-winged teal	3,900	2,386	612	Increasing
Blue-winged and cinnamon teal	7,500	5,642	900	Stable
Blue-winged teal	7,240	Not Differentiated	649	Stable
Cinnamon teal	260	Not Differentiated	30	Stable[e]
Northern shoveler	3,800	3,161	267	Increasing
Hawaiian Duck[d]	2,500	Not Applicable	2,500	Stable
Laysan Duck[d]	300	Not Applicable	300	Stable
Wood duck	4,600	Not Applicable	653	Increasing[e]
Eastern population	4,400	Not Applicable	629	Increasing[e]
Western population	200	Not Applicable	24	Increasing[e]
Muscovy duck[d]	30	Not Applicable	Not Applicable	Decreasing[e]
Whistling ducks	215	Not Applicable	Not Applicable	Increasing[e]
Fulvous whistling duck	Unknown	Not Applicable	Not Applicable	Increasing[e]
Black-bellied whistling duck	Unknown	Not Applicable	Not Applicable	Increasing[e]
Redhead	1,200	796	217	Stable
Canvasback	740	648	50	Stable
Scaup	5,200	4,051	525	Decreasing
Lesser scaup	4,400	3,484[i]	525	Decreasing[f]
Greater scaup	800	568[i]	Not Applicable	Stable[f]

Species/Sub-Population/Race[b]	1993 – 2002 Mean Population Estimates[a] Continental	Traditional Survey Area[c]	Other Survey Areas[c]	Long-Term Trend (1970– 2002)
Ring-necked duck	2,000	1,065	679	Increasing
Ruddy duck	1,100	566	189	Increasing
Masked duck[d]	6	Not Applicable	Not Applicable	Unknown
Harlequin duck	252	Not Applicable	17	Stable[e]
Eastern population	2	Not Applicable	Not Applicable	Stable[e]
Western population	250	Not Applicable	25	Stable[e]
Long-tailed duck	1,000	171	112	Decreasing[e]
Eiders	1,643	11	27	Decreasing[e]
King eider	575	Not Differentiated	Not Applicable	Decreasing[e]
Common eider	1,050	Not Differentiated	Not Applicable	Decreasing[e]
American race	300	Not Differentiated	Not Applicable	Decreasing[e]
Northern race[d]	550	Not Differentiated	Not Applicable	Decreasing[e]
Hudson Bay race[d]	100	Not Differentiated	Not Applicable	Decreasing[e]
Pacific race	100	Not Differentiated	5	Decreasing[e]
Steller's eider[d]	1	Not Differentiated	1	Decreasing[e]
Spectacled eider[d]	17	Not Differentiated	17	Decreasing
Scoters	1,600	899	15	Decreasing
Black scoter	400	Not Differentiated	Not Applicable	Decreasing[e]
Surf scoter	600	Not Differentiated	1	Decreasing[e]
White-wing scoter	600	Not Differentiated	14	Decreasing[e]
Goldeneyes	1000	749	223	Stable
Common goldeneye	750	Not Differentiated	43	Stable
Barrow's goldeneye	250	Not Differentiated	180	Stable[e]
Eastern population	5	Not Differentiated	Not Differentiated	Stable[e]
Western population	250	Not Differentiated	180	Stable[e]
Bufflehead	1,400	931	358	Increasing
Mergansers	1,600	699	794	Increasing
Hooded merganser	350	Not Differentiated	230	Increasing[e]
Red-breasted merganser	250	Not Differentiated	9	Increasing[e]
Common merganser	1,000	Not Differentiated	235	Increasing[e]

[a] Traditional Survey Area estimates were derived from the Waterfowl Breeding Population and Habitat Survey (WBPHS), strata 1-18, 20-50, 75-77. Other Surveyed Area estimates were derived from some combination of WBPHS strata (51-57, 62-69), the Breeding Waterfowl Plot Survey also conducted in eastern Canada, and concurrent state, provincial, or regional breeding waterfowl surveys in British Columbia, California, Colorado, Connecticut, Delaware, Florida, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Nebraska, Nevada, New Hampshire, New Jersey, New York, Oregon, Pennsylvania, Rhode Island, Utah, Vermont, Virginia, Washington, Wisconsin, and Wyoming. In cases where a survey was not completed every year between 1993 and 2002, or when data were unavailable, mean estimates were computed using available estimates for that time period. Continental estimates include the surveyed area estimates as well as rough estimates of populations outside of surveyed areas based on harvest derivation studies, expert opinion, winter survey data, or special purpose research surveys. Continental estimates for species such as the muscovy, whistling ducks, masked duck, and many sea ducks are based on few data and are particularly speculative.

[b] Sub-populations are identified distinctly when there is significant evidence for allopatry. Races are also distinguished according to current taxonomic classification and refer to genetically distinct sub-species. The taxonomic delineation presented in this table is intended to aid in development of regional habitat conservation strategies and is not intended to supercede other international agreements regarding the appropriate organizational level for species management.

[c] ”Not differentiated” indicates that the survey protocol does not enable discrimination to a particular taxonomic level. “Not applicable” indicates that the species, race, or sub-population is not recorded in the WBPHS Traditional Survey Area or in the surveys represented by the Other Surveyed Area Category.

[d] Not shared among two or more signatory nations. Management is the responsibility of that nation whose boundary coincides with the range of the species, sub-population, or race.

[e] Trend estimates based on a variety of data sources (e.g., Mid-winter Survey, Breeding Bird Survey, published accounts) other than breeding population estimates from the WBPHS. In general, less confidence is attributed to these estimates.

[f] 1993-2001.

[g] 1994-2000.

[h] Winter population estimate.

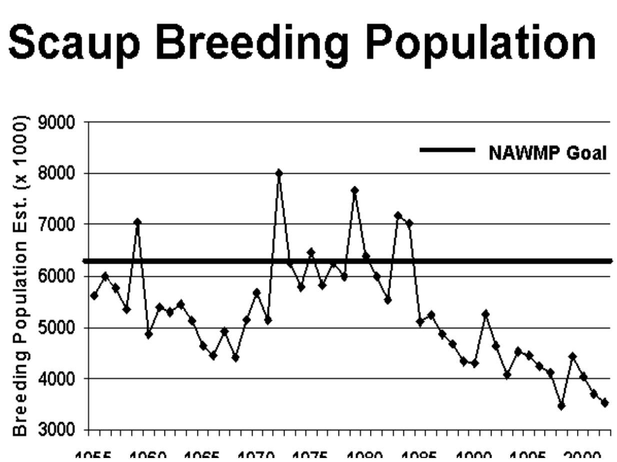
[i] Estimate of lesser scaup in the traditional survey area was computed from non-tundra WBPHS strata 1-7, 12, 14-18, 20-50, 75-75. Estimate of greater scaup in the traditional survey area was computed from tundra strata 8-11 and 13. These can be considered only crude estimates since some mixing of lesser and greater scaup occurs in tundra and northern boreal strata.

Several dabbling, perching, and whistling duck species occur only in the southern United States and Mexico. Mexican ducks, once considered a distinct species, are now classified as a race of mallards. The range of Mexican ducks once overlapped with mallards in extreme south-central and south-western United States. Today, because of hybridization with mallards, it is unlikely that pure Mexican ducks exist north of the United States-Mexico border. Mottled ducks and muscovy ducks are primarily non-migratory. The Florida (Nominate) Race of mottled duck has exhibited a short-term increasing trend, but interbreeding with feral mallards is a cause for concern. Also, rapid changes in Florida's landscape, mostly resulting from agricultural and urban development, raise concerns about the status of the wetland and upland habitats upon which the Florida mottled duck depends. Limited data for the Western Gulf Coast Race of mottled ducks has shown no trend. Muscovy ducks and the fulvous and black-bellied whistling ducks are recorded during the Mexican mid-winter survey. The whistling ducks tend to be nomadic, exhibiting unpredictable movements. The limited data that exist for the whistling ducks suggest an increasing long-term trend for both species. Opinion among some Mexican biologists is that the muscovy has declined in abundance since the 1970s.

Two resident endemic ducks inhabit the Hawaiian archipelago. The Hawaiian duck, utilizes freshwater habitats and is relatively widespread across the island chain. Wetland loss, mortality from non-native predators, over-hunting, and inter-breeding with feral mallards pose challenges to this species conservation. The Laysan duck is resident to the small island of Laysan, approximately 225 km northwest of the primary Hawaiian chain as well as other islands in the archipelago. This species utilizes a broad range of habitats from inland areas to brackish lagoons. A combination of over-hunting and vegetative changes caused by introduced rabbits had nearly extirpated this species from Laysan Island by the early 1900s. Declaration of the island as a bird reservation and eventual eradication of the non-native rabbit population allowed the population to increase to its present size of around 300 individuals.

Status of Diving Ducks, Stifftails, and Sea Ducks

North American diving ducks include the canvasback, redhead, ring-necked duck, greater scaup and lesser scaup. Stifftails in North America include the ruddy duck and masked duck. Highest breeding densities of diving ducks and stifftails occur on the prairie-parklands, although the ring-necked duck and lesser scaup are widespread and the greater scaup breeds mainly in the sub-Arctic. Masked ducks occur from central Mexico and the Caribbean south into South America. Diving ducks tend to use deeper inland marshes, rivers, and lakes for breeding and migration, and coastal bays, estuaries, and offshore waters for wintering. Canvasbacks and redheads exhibited increasing population trends in the mid-continent region during the late



1990's, but have been variable in more recent years. The long-term trend for both redheads and canvasbacks is stable (Table 2). The status of the individual scaup species is difficult to discern, because the two species cannot be reliably distinguished during aerial surveys. The size of the entire scaup population (primarily composed of lesser scaup: see Table 2) has declined over the past decade, continuing a long-term decline that has heightened concerns about these species. Public management agencies and non-governmental organizations have allocated additional resources to address the problem.

Estimates for breeding populations of ring-necked ducks and ruddy ducks in the mid-continent region are not considered as reliable as those for other diving duck species. Nevertheless, these species appear to have increased in abundance over the long term. No data are available to assess the status of masked ducks.

North American sea ducks include the harlequin duck, long-tailed duck, bufflehead, common eider, king eider, spectacled eider, Stellar's eider, white-winged scoter, surf scoter, black scoter, common merganser, red-breasted merganser, hooded merganser, common goldeneye, and Barrow's goldeneye. These birds breed primarily throughout the northern regions of the continent. Sea ducks are the least understood group of North American waterfowl. Basic biological information is limited for most sea ducks as are reliable population indices and trends. Available information suggests that all 3 merganser species and bufflehead have exhibited long term population increases, whereas goldeneyes have exhibited no apparent trend. There are indications of declines in at least half of all sea duck species, however, and spectacled and Steller's eiders are listed as threatened in Alaska, while harlequin duck and Barrow's goldeneye are listed as species of special concern in eastern Canada. Available data indicate possible significant declines for long-tailed duck, king and common eiders, and all 3 species of scoters.

"Sea ducks are the least understood group of North American waterfowl. Basic biological information is extremely limited for most sea ducks as are reliable population indices and trends."

Breeding habitat conditions for most sea duck species have not changed markedly in recent years. However, logging in the boreal forest may limit nest site availability for cavity nesting sea ducks (e.g., goldeneye, bufflehead). Many traditional wintering areas have been degraded by industrial and urban development on both coasts, and threats are continuing. Effects of habitat degradation on sea ducks are unknown. Harvest of sea ducks remains poorly quantified.

An international Sea Duck Joint Venture was established in 1999 to facilitate and coordinate the acquisition of knowledge in order to better understand the reasons for observed declines in populations and formulate restoration strategies.

Goose Population Objectives

The Plan recognizes 34 populations within 7 species of geese and establishes goals for 28 populations. Goose populations occupy traditional breeding and wintering grounds each year and move between these areas using traditional migration corridors. These movements subject individual populations to distinct factors influencing recruitment and mortality and frequently warrant population-specific management planning. Consequently, the Plan includes objectives for numerous populations of Canada geese, snow geese, white-fronted geese, and brant. These populations have been delineated for management purposes and may include members of more than one race for some species.

Snow geese, Ross's geese, white-fronted geese, emperor geese, brant, and many populations of Canada geese, nest in the northernmost reaches of North America and along the shore of the Hudson and James Bays. Several Arctic-nesting goose populations have reached record-high abundances and are considered overabundant. Such large populations have been attributed to high adult survival resulting from the abundance of forage in agricultural fields and the availability of refuges on wintering and migratory ranges. Overabundant resident Canada geese are causing significant damage to croplands, parks, and golf courses. Potentially irreparable damage to Arctic breeding habitats has also occurred as a result of intensive snow and Ross's goose foraging. Other Arctic and sub-Arctic nesting goose populations have, however, failed to achieve Plan objectives. The Arctic Goose Joint Venture (AGJV) was established to improve both monitoring and coordinated research of Arctic and sub-Arctic nesting goose populations. This joint venture has helped to identify factors that have contributed to the overabundance of some populations and limited the growth of others. Management recommendations developed through this joint venture have been widely adopted by public management agencies.

Among many other management applications, AGJV projects have resulted in the redefinition of several Arctic goose populations. AGJV partners are effectively working to support a sound biological foundation for Arctic goose management by continuing to generate significant new information. This information will help decision makers refine regulations and take action to support management of Arctic goose populations.

Plan population objectives for geese were drawn from existing goose population management plans developed by the Flyway Councils. These plans consider factors such as optimal population size for population maintenance, breeding ground carrying capacity, recreational demand, concerns related to crop depredation, and the potential for disease outbreaks.

Status of Canada Geese

There are 11 recognized races of Canada geese in North America (Appendix E). These races are further sub-divided into 19 populations for management purposes, some of which are comprised of more than one race. Of the 14 populations for which goals have been established, ten currently exceed Plan objectives. Of these, the Atlantic Flyway Resident, Mississippi Flyway Giants, Western Prairie and Great Plains (two populations presently managed jointly), Rocky Mountain, and Hi-Line populations are still increasing. The Short Grass Prairie population of Canada geese is currently showing decline, however, this population remains above the Plan goal. The Atlantic, Southern James Bay, Cackling, and Aleutian populations are presently below Plan objectives (Table 3). Dusky Canada geese, in particular, remain a race of concern. Increased predation during nesting and brood-rearing periods may be limiting population growth of Dusky Canada geese. Habitat changes following a major earthquake in 1964 may be largely responsible for the increased predation. Hunting mortality may also play a role in limiting Dusky Canada geese, although a strict quota system has been implemented to prevent over-harvest of this population.

Status of Snow Geese and Ross's Geese

Two races of snow goose are recognized worldwide, with both occurring in North America (Appendix E). The Lesser Race has been sub-divided into four managed populations, while the larger Greater Race is managed as a single population. All snow goose populations, except the Wrangel Island Population, have reached or exceeded Plan objectives. Strategies for checking future growth are currently being implemented and their success evaluated. Challenges associated with the overpopulation of the Mid-Continent Lesser Snow Goose Population are particularly acute. Despite the encouraging results of initial remedial measures aimed at greatly increasing harvest, the Mid-winter Index for this population still exceeds Plan objectives by nearly a million and a half birds. It is uncertain whether regular harvest alone will be sufficient to reduce the size of this population to the Plan objective or if additional control measures will be necessary. The Greater Snow Goose Population also greatly exceeds Plan objectives and continues to increase. No geographic variation is recognized in the Ross's Goose and no races are described. The most recent 3-year mean population estimate for Ross's geese currently exceeds the Plan objective by over 500 percent and this population continues to increase. In parts of the species range, proposals to reduce

> **"The Arctic Goose Joint Venture... has helped to identify factors that have contributed to the overabundance of some populations and that have limited the recovery of others."**

Ross's Goose numbers are being considered.

Degradation of Arctic breeding areas and surrounding landscapes by foraging snow geese and Ross's geese is a primary concern, having negative impacts on other nesting Arctic bird species as well. Impacts to coastal arctic breeding habitats have been particularly acute in the Hudson Bay Lowlands, a 1,900-km band of salt marsh occupying the western coast of Hudson and James Bays. The combined foraging pressures exerted by Lesser Snow and Ross's geese have destroyed an estimated one-third of the salt marsh in this region and damaged or overgrazed much of the remaining habitat. Studies conducted on Bylot Island, a major concentration area for breeding Greater Snow Geese, indicate high levels of grazing and suggest reduced plant productivity, however, there does appear to be re-growth following grazing. Field studies in the western arctic are more limited, yet photographic inventories of Banks Island indicate vegetation changes that may have resulted from snow goose grazing.

Status of White-fronted Geese

Three races of white-fronted geese occur in North America (Appendix E). Three populations have also been delineated for management purposes, one of which, the Mid-continent Population, aggregates members of two races. Previously, Plan objectives divided white-fronted geese that migrate through the Central Flyway to winter along the Gulf of Mexico into Eastern and Western Mid-Continent Populations. An analysis of neck collar data demonstrated that Mid-continent white-fronted geese are better described as a single population for management purposes. Accordingly, Table 3 lists a single Mid-continent Population. Autumn surveys for this population began in 1992. While this population currently exceeds the Plan objective by over 50 percent, there are indications that population growth has stabilized and, possibly, early indications (e.g., increasing mortality rates) of decline. The Pacific Population of white-fronted geese breeds primarily on the Yukon Delta of Alaska and winters in the Central Valley of California. The Tule Population is known to breed only in a restricted region of southeast Alaska around the Upper Cook Inlet and also winters in the Central Valley. Recent estimates of the Pacific Population of white-fronts are above goal, while the Tule Population remains below its Plan objective.

Status of Brant Geese

At least two races of Brant occur in North America (Appendix E), the Light-bellied and Black-bellied Brant. Two populations of Light-bellied Brant (i.e., Atlantic and Eastern High Arctic) breed in eastern Arctic Canada. The Atlantic Brant Population has recovered since crashing in the 1970's as a result of severe winter conditions. This population currently exceeds the Plan objective. The Eastern High Arctic Population breeds in the Canadian Arctic between the eastern Queen Elizabeth Islands and northern Ellesmere Island. This population of brant winters almost exclusively in Ireland and stages in Iceland during both spring and fall migration. The Eastern High Arctic Population appears stable at this time.

The Pacific, or Black-bellied, Brant Race breeds in the western Arctic of North America. In the early 1980's a dramatic decline and redistribution of Pacific Brant occurred in western Alaska, a particularly important breeding region for this population. The 3-year mean population estimate for Pacific Brant is 88 percent of the Plan goal. The Pacific Brant population is presently considered stable. Recent banding and morphological research document a breeding convergence of the Pacific Brant with the Light-bellied Brant (i.e., Atlantic Brant). While not yet taxonomically differentiated, this Brant, sometimes referred to as Grey-bellied, has been recognized as a distinct Western High Arctic Population. The Western High Arctic Population breeds on the Parry Islands of the Northwest Territories and winters in Puget Sound. A population objective of 12,000 wintering birds has been established, however, regular winter survey counts are not yet available.

Status of Emperor Geese

This maritime goose breeds in coastal tundra habitats in Alaska and Eastern Siberia and winters along the shores of the Aleutian Islands and the Gulf of Alaska, with smaller numbers in Kamchatka. Breeding surveys conducted in Alaska show the Emperor Goose population to be stable at a level less than half of the population objective.

Status of the Hawaiian Goose

The Hawaiian goose is the only native goose species of the Hawaiian archipelago. It is non-migratory and utilizes a range of habitats from volcanic uplands to lowland wetlands. This species was once decimated by over-hunting and predation by non-native species. An extensive captive-rearing and reintroduction program was begun in 1949 and has aided in increasing the population to its present size of 1,175.

Swan Population Objectives

No races are recognized for any of the three swan species considered in the Plan. For management purposes, objectives are specified for two populations of tundra swans and three populations of trumpeter swans (Table 4). Tundra swan breeding ranges encompass most of the Arctic and sub-Arctic, from the west coast of Alaska to the northwest coast of Quebec. The Eastern Population winters primarily in the Mid-Atlantic States surrounding Chesapeake Bay and Albemarle-Pamlico Sounds. The Western Population winters at various locations along the Pacific Coast, from southern British Columbia and the Central Valley of California, south to the lower Colorado River in southwest Arizona and California.

The current breeding range of Trumpeter swans is part of a much larger historic range that encompasses the prairies, boreal forests, and intermountain region from southern Alaska through southern Wyoming and east to the western Great Lakes and northern Ontario. Vigorous reintroduction efforts are underway in portions of this species' historic range. The Pacific Coast Population (PCP) is the largest of the three recognized populations. It breeds throughout most of Alaska south of the tree-line, Southwestern Yukon, and extreme Northwestern British Columbia, and winters primarily on the Pacific Coast from Southeast Alaska to Washington state, with smaller numbers in parts of interior British Columbia. The Rocky Mountain Population (RMP) breeds in the Yukon, British Columbia, Northwest Territory, and Alberta, and in Montana, Wyoming, Idaho, Oregon, and Nevada. It winters primarily in the Tri-state area of Wyoming, Montana, and Idaho, with small numbers at other scattered locations in Nevada and Oregon. The Interior Population (IP) is composed of many restoration flocks that now breed in Canada in Saskatchewan and Ontario, and in the US from eastern Montana to the eastern end of Lake Ontario. An abundance-based objective for the Rocky Mountain Population is currently being debated, and an interim objective to sustain a minimum growth rate is in effect.

The mute swan is native to Europe and was introduced to private estates in the United States in the late 1800s for aesthetic purposes. Initial introductions were in the vicinity of Long Island, New York. By about 1910 some of these captive birds had escaped resulting in a feral population of breeding swans in southeastern New York. While mute swans are for the most part non-migratory, some seasonal migrations, and at times more lengthy migrations, do take place. By the 1970s wild populations of mute swans were established in all four Flyways and in Canada. Though an exotic, the mute swan has recently been added as a species protected under the Migratory Bird Treaty Act. The increasing population of mute swans is of management concern. The aggressive nature of this species has created concern about competition between mute swans and native species of waterfowl. Also, the feeding habits of this species can degrade the quality of habitats for native species. Where concentrations occur, eat-outs of submerged aquatic vegetation have been reported. Management policies are being considered by the Flyways and Federal Governments of the United States and Canada in order to address the growing population of feral mute swans.

Status of Tundra Swans

The mean number of tundra swans in the Eastern Population over the past 3 years exceeds the Plan objective by approximately 30 percent while the 3-year mean for the Western Population exceeds the Plan objective by approximately the same percentage. Recent trends indicate the Eastern Population to be increasing, while the Western Population appears to be stable.

Status of Trumpeter Swans

All three populations of trumpeter swans increased in abundance between 1990 and 2000. The Pacific Coast Population currently exceeds its population objective by 35 percent and the Rocky Mountain Population is estimated to have increased by 9.1 percent per year during the 1990s, exceeding its interim population objective of 5 percent annual growth rate. The Interior Population currently exceeds its population objective by over 21 percent. Objectives for trumpeter swans are currently undergoing international review.

Status of Mute Swans

Mute swans have exhibited increasing population trends particularly in eastern North America. The Atlantic Flyway Mute Swan Mid-Summer Survey reported a 13 percent increase in total swans between 1999 and 2002 with an estimated Flyway-wide population over 14 thousand birds. Since 1986, data from this survey indicate that the feral mute swan population has increased in size over 148 percent. The Mississippi Flyway also hosts approximately 5 thousand mute swans, most of which occur in Michigan. The Central and Pacific Flyways support significantly smaller feral populations.

Table 3. Status and goals for North American goose populations.

Species/population	*Population Mean (2000-2002)[a]*	*Population Trend (1993-2002)[b]*	*Population Objective*
CANADA GEESE			
Atlantic	134,900	Increasing	175,000[c,d]
Atlantic Flyway Resident	997,700	Increasing	650,000[e,f]
North Atlantic	No estimate	No estimate	Not yet established
Southern James Bay	89,400	Stable	100,000[e]
Mississippi Valley	598,600	Stable	375,000[e]
Mississippi Flyway Giants	1,442,900	Increasing	1,000,000[e]
Eastern Prairie	235,600	Stable	200,000[e]
Western Prairie and Great Plains	662,600	Increasing	285,000[g]
Tall Grass Prairie	316,500	Stable	250,000[g]
Short Grass Prairie	175,000	Decreasing	150,000[g]
Hi-Line	246,900	Increasing	80,000[g]
Rocky Mountain	162,229	Increasing	117,100[e]
Pacific	No estimate[h]	No estimate[h]	Not yet established
Lesser	No estimate	No estimate	Not yet established
Dusky	17,300	Stable	Avoid ESA[i] listing
Cackling	181,700	Stable	250,000[j]
Aleutian	33,400	Increasing	40,000[g]
Vancouver	No estimate	No estimate	Not yet established
Taverner's	No estimate	No estimate	Not yet established
SNOW GEESE			
Greater	763,500	Increasing	500,000[k]
Mid-continent Lesser	2,478,200	Stable	1,000,000[g]
Western Central Flyway Lesser	114,400	Stable	110,000[g]
Wrangel Island Lesser	102,500	Increasing	120,000[e]
Western Arctic Lesser	486,000	Increasing	200,000[e]
ROSS'S GEESE	619,000	Increasing	100,000[e]
WHITE-FRONTED GEESE			
Mid-continent	914,300	Stable	600,000[j]
Tule	5,500[l]	Stable	10,000[g]
Pacific	381,200	Increasing	300,000[j]
BRANT			
Atlantic	161,400	Stable	124,000[g]
Pacific	132,000	Stable	150,000[g]
Western High Arctic	No estimate	No estimate	12,000[g]
Eastern High Arctic[m]	20,000	Stable	Not yet established
EMPEROR GEESE[m]	68,600	Stable	150,000[e]
HAWAIIAN GOOSE[m]	1,175	Stable	2,800[e]

[a] Incomplete survey years were excluded from the computation. Where no estimates are available for 2000-2002, the most recent estimate is presented.
[b] Many goose population surveys, particularly breeding ground surveys, have shorter periods of record than surveys established for ducks. For this reason trend estimates are based on a shorter, 10-year, interval, or for the period of record when 10 years of data are not available.
[c] Breeding pair index.
[d] Objective partitioned: 150,000 pairs Ungava Peninsula; 25,000 pairs boreal Quebec.
[e] Total spring population.

[f] Reduce to this level by 2005.
[g] Winter population.
[h] State and provincial surveys exist but it is not yet possible to develop a population-wide index.
[i] ESA – Endangered Species Act (United States).
[j] Autumn population.
[k] Spring population.
[l] Population estimates based on neck collar observations during the winter.
[m] Not shared among two or more signatory nations. Management is the responsibility of the nation which encompasses the range of the population, sub-population, or race.

Table 4. Status of and goals for North American swan populations.

Species and Population	*3-Year Winter Population Mean (2000-2002)*	*Recent Trend (1993-2002)*[a]	*Population Objective*
TUNDRA SWANS			
Eastern Population	101,800	Increasing	80,000[b]
Western Population	79,500	Stable	60,000[b]
TRUMPETER SWANS			
Pacific Coast Population	17,551[c]	Increasing[d]	13,000[e]
Rocky Mountain Pop.	3,666 (9.1%)[c,f]	Increasing[d]	5% annual growth rate[g]
Interior Population	2,430[c]	Increasing[d]	2,000[e]
MUTE SWANS	20,000[h]	Increasing[h]	Not yet established

[a] Swan population surveys have shorter periods of record than surveys established for ducks. For this reason trend estimates are based on a shorter, 10-year, interval, or for the period of record when 10 years of data are not available.
[b] Winter population
[c] 2000 Index from the North American Trumpeter Swan Survey conducted every 5 years.
[d] Over the period 1990-2000.
[e] Autumn population.
[f] Average annual growth rate 1995-2000.
[g] Interim objective specified until an abundance objective is adopted.
[h] Based on the Atlantic Flyway Mute Swan Mid-Summer Survey and individual state survey data from the Mississippi, Central, and Pacific Flyways.

Relationship of Population Objectives to Habitat Objectives

The Plan specifies its ultimate objectives in terms of the abundance and distribution of North American waterfowl populations. Its goal is to meet population objectives through the wise application of local or regional-scale habitat conservation actions guided by regional habitat conservation objectives. To accomplish this, Plan partners strive to quantitatively link regional waterfowl habitat objectives with continental waterfowl population objectives. Empirical and conceptual biological models provide means to link population and habitat objectives[4].

[4] Appendix A. Model-based Strategic Planning and Evaluation for Waterfowl Conservation.

Eighteen years after the inauguration of the Plan, the empirical basis for regional habitat objectives varies widely among joint ventures. The amount of baseline life-history information available for individual waterfowl species varies considerably by geographic region. So does information on resource utilization by waterfowl and environmental influences on bird demography. This disproportionate availability of baseline data is the result of many factors, including the logistical ease and cost of working in different environments, the geographic location of public and private research institutions with waterfowl expertise, geographic differences in the perceived relative importance of waterfowl in relation to other wildlife resources. The joint venture habitat conservation objectives presented below reflect this geographic variability in the quantity and quality of scientific information on bird-habitat relationships. While some objectives have been derived and evaluated with the aid of empirical models, others are based more heavily on expert opinion. The ongoing challenge to Plan partners is to develop models for habitat conservation and to evaluate and refine these models to improve habitat conservation strategies. A review of joint venture habitat objectives and the methods used to derive them will be part of the Plan's comprehensive progress assessment scheduled for 2003-2005.

"Plan partners strive to develop models linking regional waterfowl habitat objectives with continental waterfowl population objectives."

Table 4. Joint Venture Habitat Objectives (acres)

Joint Venture	Protect/Secure	Restore/Enhance
Atlantic Coast	945,000	209,790
Central Valley Habitat	200,000	734,555
Eastern Habitat	1,435,230	1,221,550
Gulf Coast	1,129,972	921,016
Intermountain West	1,500,000	1,000,000
Lower Mississippi Valley	407,000	2,046,000
Pacific Coast	249,000	108,000
Playa Lakes	51,000	35,000
Prairie Habitat	6,672,240	-
Prairie Pothole	1,891,315	4,409,398
Rainwater Basin	50,000	38,333
San Francisco Bay	107,000	129,000
Upper Miss./Great Lakes	758,572[5]	-

[5] Habitat Objective is to conserve additional acres through securement, protection, restoration and enhancement

V. Strengthening the Scientific Base for Plan Implementation

Sound Science is Essential for Effective Conservation

The three visions of the 1998 Plan Update were 1) conserving landscapes to sustain waterfowl populations, 2) broadening partnerships, and 3) strengthening the biological foundations of waterfowl conservation. The Plan Committee reaffirms the importance of each of these, and believes that progress on the first two elements has been successfully evolving in all three nations. The Committee now feels that it must focus particularly on strengthening the Plan's biological foundations as we move into the second 15-year phase of Plan implementation.

Within the context of continental bird conservation, it is imperative that each bird initiative develops a sound scientific basis for conservation. Sound science helps ensure that management actions have the predicted biological consequences and that management choices are optimal, or at least appropriate, at national, regional, and local levels. Development of a strong scientific base underpins everything the Plan does and is the key to the Plan's

Biological Foundations

Waterfowl and their habitat needs are the common bond that connects our three nations and four Flyways in pursuit of Plan goals.

The Plan's vision of landscapes capable of sustaining waterfowl populations is made tangible only by an understanding of the habitat conditions necessary to sustain target populations throughout their annual cycle. The Plan's biological foundation, therefore, includes waterfowl population objectives, habitat objectives, and an understanding of the linkages between them. It encompasses the ecological understanding of factors that affect the distribution and abundance of waterfowl, and especially the linkages between landscape changes (e.g., water abundance, land use, habitat quality, and Plan conservation actions) and waterfowl vital rates (e.g., recruitment rates, mortality rates and population growth rates). Such knowledge is essential for science-based waterfowl management.

Plan population objectives are set based on historic abundances of species and consensus among waterfowl stakeholders about population levels that ensure population viability and provide for harvest and other forms of public enjoyment. Once established, population objectives, in turn, direct managers to target certain habitats for attention and to design specific conservation actions in order to sustain populations.

The cost-effectiveness of conservation actions depends crucially on providing the right resources in the right places. Our ecological understanding of factors affecting waterfowl populations directs those decisions. Thus, the biological knowledge base is truly the foundation for the Plan's success.

Because of a rich scientific history and extensive practical management experience, the Plan is fortunate to have a broad scientific base on which to build conservation plans. This varies greatly, however, among species and regions. For instance, we know a great deal more about mid-continent mallards than we do about king eiders in the central Arctic or masked ducks in Mexico. Regardless of the Plan's strong positioning, waterfowl live in an ever-changing world and their habitats are under unrelenting pressure from human development. Consequently, managers are challenged to make conservation decisions and investments in the face of much uncertainty about the impact of their actions on waterfowl populations. Plan partners are continually challenged to improve the biological foundation on which key conservation decisions depend and to continuously improve their work through adaptive management.

continuing leadership in conservation. It is equivalent to private sector investments to improve product quality and maximize benefit:cost ratios. As the joint ventures broaden their conservation mandates and pursue multi-species management, continental leadership for waterfowl science is even more important.

Waterfowl conservation continues to rely heavily on traditional research and development by Plan partners. The importance of continued monitoring cannot be overstated. National data sets describing population trends and distribution, including those describing the harvest, are fundamental to the science base. Typically pursued independently from routine program delivery, research and development remain the main avenue for developing and testing most new ideas. In waterfowl conservation there are two main approaches to research and development. The first is basic research to better understand how ecological systems work (such as carbon sequestration in wetlands) or what has gone wrong (such as scaup declines in the western boreal forest). The second is field testing new program ideas such as duck use and nesting success in fall-seeded cereal crops. The results from such research are used to develop new programs or direct other conservation actions.

Adaptive Management

As a complement to traditional research the Plan Committee is increasingly promoting the use of adaptive management. Adaptive management (AM) is a broad concept allowing for a diversity of approaches. The unifying thread is a focus on the uncertainty that attends management decisions and recognition that management actions themselves offer one important means for reducing uncertainty. Here we use adaptive management in a broad and inclusive sense to mean the use of iterative cycles of planning, implementation, and evaluation to improve management performance. Specific applications range from simple assessments of straightforward management choices to formal application of statistical decision theory (as in adaptive harvest management). Plan managers, therefore, design conservation activities to have significant biological impact, but also to provide opportunities for learning to inform future management decisions.

"The cost-effectiveness of conservation actions depends crucially on providing the right resources, in the right places, for all species."

To manage adaptively, each conservation program must have clear, quantifiable objectives; specific predicted biological outcomes of alternative management actions; monitoring procedures to measure the outcome variables defined in the objectives; an evaluation process to compare outcomes with original objectives; and a commitment to use the lessons learned to adjust future delivery. The monitoring and evaluation components may vary from simple monitoring of the results of routine management to rigorous experimental delivery of alternative management options. AM does not need to be complex, but it does require discipline. Critical pre-conditions for successful AM include stakeholder consensus about objectives and a commitment to manage adaptively. AM is useful only if partners will respond to new knowledge.

At regional, national and continental levels, the Plan can enhance its cost-effectiveness by improving capacity in all three iterative steps: planning, implementation, and evaluation. Planning – at all levels – is based on a set of assumptions, often embodied in implicit or explicit models. These predict how waterfowl will respond to habitat changes and management actions. Strategic planning incorporates this biological foundation (our existing “assumption set”) in selecting priority areas for specific management actions.

Strategic planning also will determine the distribution of Plan resources among direct habitat interventions, policy reform, technical assistance, and public education. Whether empirical or conceptual, such models should be tested wherever the impact of the associated management decision is great and the uncertainty is significant. A strong biological foundation is as important for the design of effective conservation policies as it is for delivery of grassland easements or wetland restorations. Moreover, AM can provide a framework for learning how to modify public policies more effectively.

The Prairie Habitat Joint Venture (PHJV), with its commitment to biological monitoring and assessment, has institutionalized adaptive feedback for conservation and demonstrated how investments evaluation can improve conservation success.

Improving Conservation Planning

In the 1980s, PHJV partners merged the U.S. Fish and Wildlife Service Mallard Productivity Model with an economic module developed by Ducks Unlimited Canada. By using this tool to predict duck production before and after hypothetical implementation, planners could select among suites of programs needed to achieve PHJV population goals. Their work resulted in the first-ever biologically based conservation plan for western Canada.

In the spirit of adaptive management, a PHJV Assessment Study was then used to evaluate the effectiveness individual treatments and test the assumptions and parameters in the Mallard Productivity Model. The model, developed mostly from studies in northern U.S. grasslands, did not predict waterfowl production rates well when planners applied it in the Parklands where most Canadian habitat programs were delivered. New data collected during the Assessment have since been applied to develop a simpler, multi-species, decision support system that uses wetland and land-cover characteristics to predict waterfowl densities and breeding success. This new spatially explicit production model now guides program delivery in both Prairie and Parkland regions. It is also helping the PHJV integrate waterfowl planning with other bird conservation initiatives, and can be used to estimate potential gains from changes in public policy. A new monitoring project is now underway to further test and refine this new model. Enhanced surveys and banding, and a new system of habitat monitoring, further support PHJV planning.

Modifying Conservation Programs

- Programs with disappointing results, like predator-fenced plots of nesting cover and leased nesting cover, were discontinued.
- Some programs were better focused. For example, payments to farmers to delay haying were restricted to the highest-density waterfowl areas or used in association with conversion of land from annual cropping to forage production. Conservation fallow programs were restricted to landscapes important for Northern Pintails. Nesting success was lower near wetlands and better away from edges of cover patches, leading to better targeting for restoration of perennial cover.
- Purposes of some programs were refined. For instance, rotational grazing systems are now used mainly to support conversion of land from annual cropping.
- Other actions have moved to the forefront based on evaluation results, such as promotion of fall-seeded cereal crops as alternatives to spring seeded cereals.
- Cost savings were identified. Once established, planted nesting cover maintained its productive capacity for at least 6 years before haying or burning was needed to rejuvenate the stand.

Managers have modified guidelines for nearly all PHJV conservation programs as a result of evaluations and delivery experience. Evaluation results have also fundamentally affected the PHJV's strategic outlook. It is clear that to sustain waterfowl populations intensive programs must be coupled with public policy and extension achievements that result in large-scale landscape improvements.
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Adaptive management and traditional research have complementary roles, and different mixes are appropriate in different regions depending upon the state of knowledge and stage of implementation. Examples of how joint ventures have benefited from such evaluation investments and from modified program delivery in response to new information can be found in sidebars in this chapter

Using Adaptive Management to Shift Interventions: Beaver Pond Management Assessment

Beaver ponds comprise an important mosaic of wildlife habitat in Eastern Canada. On the assumption that management actions could improve the capacity of beaver ponds to support waterfowl, the Eastern Habitat Joint Venture (EHJV) developed a beaver pond management (BPM) program to rehabilitate unproductive or abandoned beaver ponds. It included dam removal, water level manipulations, nesting structures and poplar management. Managers expected that water manipulations and provision of nesting structures might increase waterfowl breeding pair densities and brood production. Indirect benefits were expected from poplar management when beavers re-colonized abandoned ponds, utilized the poplar as food, and restored flooded conditions.

This hypothesis was tested through the BPM Assessment Program (1993-1997). The research compared waterfowl pair and brood densities and distributions on a series of managed and unmanaged ponds. The EHJV partners learned that intensive management of beaver ponds had little impact on waterfowl densities or brood production. The lack of natural nest cavities and low overall wetland productivity in the region resulted in low densities of pairs settling on these areas. Brood habitat seemed adequate for the numbers of ducks using the landscape.

These assessment results have greatly modified conservation of beaver pond landscapes. Given that intensive management of existing habitats appears to have limited impact, the best option for enhancing waterfowl production is to address the total amount of flooded habitat on the landscape. EHJV now believes that sound forestry practices (including improving poplar availability) combined with beaver management (work with trappers and provincial agencies to sustain beaver populations) is a more effective – and less costly – approach. Healthy and productive beaver populations are critical to the long-term availability and distribution of wetlands in the region. Conserving adequate food resources for beaver, sound forestry practices, and nest box deployment, should ensure adequate nest sites for cavity-nesting birds

The Plan's Scientific Agenda

The Plan Committee has delegated leadership to the NAWMP Science Support Team (NSST) both for setting the technical agenda and overseeing its implementation. NSST is a working group comprised of national-level staff, Flyway Council biologists, and biologists from the individual joint ventures. Consistent with Plan Committee guidance and NSST technical advice, Plan leaders at all levels need to ensure that scientific efforts are adequately staffed, funded, and managed to support both continental learning and regional decision-making. Key areas of scientific focus should include the following:

Population research and monitoring. Significant gaps remain in basic information on the ecology, abundance, and trends of many waterfowl populations. Moreover, we do not fully understand, for any species, how variation in habitat conditions throughout its range and annual cycle affects population change.

Science needs of habitat joint ventures. Joint ventures need to maintain monitoring and assessment systems capable of discerning habitat changes over time (including Plan interventions) at appropriate spatial scales. Presently, information is lacking to evaluate the cumulative impact of habitat joint ventures while controlling for overall net changes in land-use. Some obvious needs include more frequent and comprehensive monitoring of land use changes in the Prairie Pothole Region and population monitoring on the major waterfowl wintering areas.

Northern Pintail Action Group Advocates Accelerated Research and Management Actions

Despite record increases in May pond abundance across the U.S. northern plains and parts of prairie Canada during the 1990s, Northern Pintail populations did not increase nearly as strongly as other prairie-nesting dabbling ducks. Moreover, the estimated numbers of pintails in spring have decreased through each wet-dry cycle on the prairies since surveys began in 1955. Concerns among Plan partners prompted formation of an ad-hoc working group following an international pintail workshop in March 2001.

Workshop participants reached strong consensus: the single most important factor responsible for the lack of recovery with improved wetland conditions was poor nest success on the prairie breeding grounds. Poor nest success, in turn, is a result of the conversion of native prairie to cropland followed by continuous annual cropping. This exposes pintails to higher predation rates by an altered predator community, and the species' stubble nesting habits lead to nest losses due to both predation and farm machinery. Concerns also remain about reduced breeding propensity, impacts of disease, and adult hen survival during the breeding season.

In May 2003, the Plan Committee adopted the group's prospectus for a Pintail Action Group. The group will function as part of the NAWMP Science Support Team and will network with Plan habitat joint ventures, agencies, and NGOs throughout the continent to advocate actions in support of Northern Pintail conservation.

The Pintail Action Group will:

- Identify needed conservation actions and the evaluations required to help improve the performance of those programs.
- Serve as a forum for exchanging technical information on pintail biology and management.
- Work through joint ventures, Flyway Councils and other partners to develop science and communication recommendations for pintail recovery actions.
- Help increase funding for needed work through existing partnerships.
- Report progress annually to the Plan Committee

The Pintail Action Group recommends that Plan partners:

- Accelerate habitat conservation measures (e.g., seeding of fall cereals, cropland conversion to perennial cover, grassland protection) in prairie breeding areas at a sufficient scale to significantly reduce acreages of cultivation and spring tillage.
- Evaluate and improve the effectiveness of such programs.
- Maintain existing pintail habitats outside the prairie breeding areas.
- Support development of an adaptive harvest management framework for pintails.
- Reexamine population size and distribution, and improve population-monitoring programs.
- Enhance operational banding.
- Implement additional nesting ecology studies, studies of landscape factors that attract breeding pairs, adaptive habitat management programs, studies of cross-seasonal effects, and more rigorous tests of the multiple hypotheses that could explain the pintail decline.

Plan partners need monitoring to estimate progress toward achieving Plan goals, and to help test underlying planning assumptions and models. Where progression from population objectives to vital rate objectives is desirable, monitoring of those vital rates will also be necessary.

Joint ventures also need to develop a better understanding of how specific habitat changes affect waterfowl recruitment and survival. Similarly, Plan partners need coordinated strategies to gain insights about the effects of large-scale spatial and temporal variation in habitat conditions on waterfowl vital rates. Migration areas pose special challenges for biological assessment because of the mobility of migrating birds.

Science needs in support of certain species. Species joint ventures have been created for arctic geese, sea ducks, and black ducks to address major information gaps. For other species with major knowledge gaps, such as northern pintail and scaup, the NSST will help the Plan Committee devise mechanisms to learn more about these important species. The new Northern Pintail Action Group is one novel example. It is vital that the scientific products and expertise of the species joint ventures be fully integrated with any overlapping habitats joint ventures so that new insights are incorporated quickly in the design of habitat initiatives.

Emerging science priorities and partnerships. Factors that could greatly affect the success of the Plan are discussed in Section III. Plan partners must enhance their collective capacity to monitor and anticipate such factors and their effects, and to respond in ways that will ensure the adequacy of conservation plans. In order to meet these challenges, Plan partners must fully engage the broader scientific community within universities, cooperative wildlife research units, government agencies, and non-government organizations. Many such alliances already are contributing to the Plan's scientific foundation, but the linkages are uneven and should be strengthened at all administrative levels. The Plan must structurally link scientific partners within the Plan – the NSST is one good example – but future partnerships will necessarily be broader and include non-traditional collaborators such as climatologists, hydrologists, resource economists, and social scientists. Not all Plan science support needs are ecological in nature. Increasingly, managers also require timely economic and social data to help inform management decisions.

The Plan as a Learning Community

"Reporting what is learned throughout the Plan community will be vital to ensure that partners learn from one another and move forward in a coordinated and efficient way."

The Plan's adaptive approach to management will succeed only if joint ventures continue to expand their capacities for regional planning, implementation, and evaluation. More formal and more frequent cycles of planning, implementation and evaluation at both regional and continental scales are desirable.
Reporting what is learned throughout the Plan community will be vital to ensure that partners learn from one another and move forward in a coordinated and efficient way. The Plan Committee has tasked the NSST with promoting effective strategies for adaptive management among Partners and for communicating successful approaches to planning and evaluation to other bird initiatives. The NSST will stimulate more regular reporting and discussion of

biological progress within joint ventures, among joint ventures, and between the Plan Committee and the joint ventures. But, the NSST will be successful in its charge only if strong parallel technical committees are leading this work at the joint venture level.

> **"The Plan community is committed to improving scientific information where it is lacking and integrating the best possible science into the Plan's decision support systems."**

Because the Plan works continentally, nationally, regionally, and locally, adaptive management and strategic planning must also occur at multiple spatial scales. The spatial scale determines the relevant questions, challenges, opportunities for learning, and the scope of possible inferences. It is important to appreciate these differences while attempting to provide information relevant for decision-makers at all levels. For example, the Plan Committee requires analyses to help it prioritize activities at a continental scale, while a habitat joint venture manager would be more concerned with understanding the relationship between regional habitat variables and waterfowl vital rates. But data gathered at the JV level for local decision-making will also help inform continental prioritization. At the same time, understanding population dynamics throughout the annual cycle can help JV managers develop effective regional conservation plans. Managers at all levels benefit from efficient information sharing.

The Plan community is committed to improving scientific information where it is lacking and to integrating the best possible science into the Plan's decision support systems. The capacity of joint ventures and other implementing partners needs to be improved to provide the best possible understanding of population and landscape trends and the biological effectiveness of Plan actions. Local data gathering, in turn, will help guide continental priorities. Improving the cost-effectiveness of Plan actions, and strengthening the scientific underpinnings of waterfowl plans, are keys to maintaining the Plan's leadership role in conservation.

Applying New Technologies to Improve Management: the Eastern Harlequin Duck

Improvements in satellite-radio telemetry have enabled Plan partners to gather new data on population delineation. Even if this were possible using traditional banding and recapture techniques, the data would take years to obtain. As one of the first studies in anticipation of a new Sea Duck Joint Venture, Plan researchers applied the satellite radios to eastern Harlequin Ducks to determine affinities among breeding, molting and wintering areas.

When this population was listed as Endangered in Canada in 1990, managers thought that the entire eastern population breeding in Quebec, Labrador and Newfoundland wintered in Atlantic Canada and Maine. That wintering population totaled less than 1000 individuals. Using satellite radios during two field seasons (1997-1998), researchers learned that Harlequins breeding in northern Quebec and Labrador molt and winter in Greenland. Those breeding in the southern part of the range winter in Atlantic Canada and Maine. The understanding that there is genetic interchange between the Greenland and the North American populations – and that the overall population is greater than had been thought – has led to important management changes. The eastern Harlequin was down-listed to a Species of Special Concern in Canada. Recognizing that management scope for this species extends beyond North America, cooperative Canadian/Greenland research is underway to determine the size of Greenland's breeding and wintering populations, and genetic sampling is ongoing to determine the degree of interchange between Greenland and North America.

VI. Challenges

The cost of conserving the full spectrum of North American waterfowl and their habitats will be many billions of dollars, far beyond the means of traditional waterfowl conservation resources. Funding increases are needed, but are not the complete remedy. History shows it is possible to use the Plan's broad partnerships to reach out to other interests, integrating the needs of waterfowl with other socially-desired outcomes like clean water, clean air, and sustainable food, fiber, and energy. In this way, waterfowl conservation funds can be leveraged with the billions of dollars expended annually for these other interests. Plan partners possess a compelling tool for shaping future policies and programs. That tool is the Plan's strong scientific foundation, specifically, the ability to determine the type, amount, and location of management actions required to achieve desired population objectives.

The challenge for the Plan community is three-fold: 1) to direct available funds where they can be used most efficiently, 2) to capture the potential waterfowl benefits of a host of federal, state, and provincial programs, and 3) to improve the scientific knowledge necessary to achieve Plan goals.

To meet this challenge, the following actions are necessary::

Plan leaders, on the Plan Committee, on joint venture Management Boards, in Federal, State and Provincial governments, and in private institutions should:

- Strive to acquire resources to realize the Plan's visions and accomplish the recommendations of this Update.
- Foster appropriate linkages with other governmental and nongovernmental entities that affect waterfowl habitats in priority North American landscapes and develop effective liaison across other sectors of the economy.
- Foster appropriate linkages with areas outside of North America that are important to some species of North American waterfowl (e.g. Russia, Greenland, Latin America, and the Caribbean).
- Recognize, monitor, and address emerging social, economic, and environmental trends and seek cooperative opportunities for waterfowl conservation .
- Address the persistent deficiencies in breeding habitat in the mid-continent prairie region.
- Address conservation needs in the boreal forest, which has emerged as a high priority area.
- Complete and implement the Mexican Strategy for the Management of Waterfowl and Their Habitats

At the technical level, Joint Ventures, the NSST, and other Plan partners should:

- Identify significant limiting factors for species or populations of waterfowl exhibiting long-term population declines.
- Develop and use adaptive processes of biologically-based planning and evaluation to ensure that habitat work targets priority conservation needs of waterfowl, wherever they occur.
- Improve our knowledge of the linkages between habitat dynamics and waterfowl responses in order to design and deliver more effective waterfowl conservation programs and promote supportive public policies.

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The Plan community needs to consider whether the Plan's present organizational "form" matches its desired future "function," as detailed in this document and should:

- Examine Plan Committee roles and responsibilities, culminating in a look at Committee structure and membership.
- Strengthen scientific and operational linkages and coordination among habitat joint ventures; between habitat and species joint ventures; and among the Plan Committee, Flyways, the NSST, and all the joint ventures.

<u>NAWMP Progress Assessment 2004-2005</u>

To ensure that the Plan is on course to fulfilling its purpose, the Plan Committee, with the support of the NSST, and in cooperation with the species and habitat joint ventures, will undertake a comprehensive assessment of progress toward Plan goals. This will include an update of regional habitat objectives based on evaluation results, identification of additional science support needs, and a refined estimate of the resources needed to accomplish Plan objectives. The assessment also will solidify strategic biological planning, implementation and evaluation throughout the Plan community and renew the working relationships between the Plan Committee and the joint ventures.

"New human and financial resources will be needed to accomplish the science-support work described here. Business as usual will not allow us to attain what is advocated in the Plan"

-- partner comment from first draft consultation

It is vital that all the key Plan stakeholders participate in some manner in this review. The Plan Committee should provide international leadership in this endeavor with technical support from its Science Support Team. The joint ventures, in particular their technical committees, and associated Flyway Councils should also be full participants in the work.

The scope and process for this assessment will be elaborated in a workshop of Plan stakeholders during the winter of 2004. The assessment should begin in 2004, with a final report for the Plan community by the end of 2005. The results of this comprehensive assessment will help the Plan Committee and its partners set the stage for the 2008 Update, helping to clarify the top priority needs going forward.

Appendix A: Model-based Strategic Planning and Evaluation for Waterfowl Conservation

The fundamental premise of the North American Waterfowl Management Plan is that the cumulative effect of many local and regional conservation actions will result in dynamic, but sustainable, landscapes capable of providing for the physiological needs of waterfowl at prescribed population levels. As with all wildlife conservation, the perennial challenge for Plan partners is to synthesize available scientific data and expert opinion into models that predict the demographic effects of natural environmental variation and management interventions; to apply these models to geospatial habitat and environmental databases and develop habitat conservation objectives and criteria for the prescription of management actions; and to evaluate model assumptions to improve predictions and conservation strategies. This challenge is most effectively addressed through a tight-coupling of the planning, implementation, and evaluation phases of an iterative conservation delivery process.

The Values of Strategic Planning for Habitat Conservation

Strategic planning guides the delivery of conservation at multiple scales -- it is founded on the understanding that every part of a landscape has a unique potential to affect populations and a unique cost of conservation to management agencies and society. Collectively, biological benefits and costs determine management efficiency. The essence of strategic management is to attain the greatest possible benefit at the lowest cost. This approach demands that conservation delivery be discriminatory. That is, partners collaborate, pursuing a pre-established design of predicted sustainability. Consequently, strategic conservation planning has the greatest value when managers are willing and able to prioritize management alternatives. Planning increases the likelihood of making cost effective decisions by avoiding misapplications of management treatments and investments in areas with limited potential to affect populations. In this fashion, spatial planning represents biological quality assurance and may increase the credibility of habitat managers.

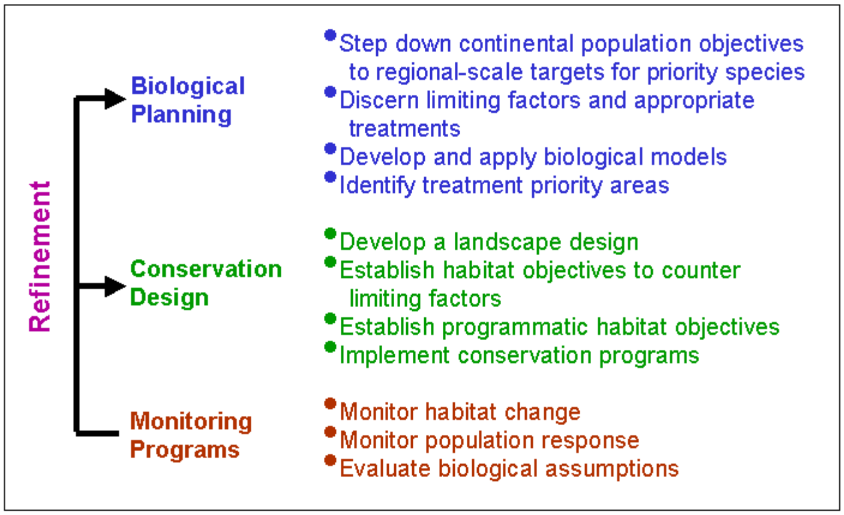
The most effective strategic conservation plans are living tools that are continually refined and updated. They provide useful guidance to multiple audiences that range from the highest-level program administrators to field managers that make day-to-day decisions about where and how to deliver management.

In simple terms, strategic conservation planning for habitat management is geographic prioritization at continental, regional, and local scales. At its coarsest scale, strategic planning identifies regions of the continent that are most important to the maintenance or recovery of populations of priority species (see Appendix B). Because regions are heterogeneous, regional strategic planning seeks to identify landscapes that are most important to priority species. Within these priority landscapes, habitat managers face choices at the project scale about what sites to secure, restore, or enhance, and managers must select from a suite of management options with differing impacts on different species. At each scale, planning benefits from the use of a systematic process that relates priority birds to their habitats. In general, the reliability of planning predictions will improve as spatial scales, and the biological information planning is based on, become more refined.

Inasmuch as they affect habitat management decisions by partners, joint venture implementation plans are examples of regional strategic conservation plans. A joint venture implementation plan should provide biological input into their partners' collective and individual management decision processes, including:

1) where to deliver habitat conservation to maximize population impacts;
2) what form management should take at a site given habitat condition and landscape structure; and
3) how much habitat is required to attain joint venture population objectives.

These attributes may be described as (1) a design for landscapes that embraces similarities and differences in the ways a joint venture's priority species relate to landscapes, local site characteristics, and management activities, and (2) explicit objectives for habitat associations that are adequate to meet population objectives for these species. These are the core elements of a biologically-driven conservation strategy, and are a foundation for efficiently delivering the diverse programs that are the implementation tools of joint ventures and the partners that comprise them. The process of developing and refining a biologically-driven conservation strategy is depicted in the adjacent figure.



Because strategic plans with these attributes include a geographic component, they are referred to as spatially-explicit plans. Spatially-explicit conservation plans are powerful tools for building and maintaining partnerships and for conveying the goals and strategies of partnerships. They are useful because they direct conservation at priority areas and unite partners in a common set of approaches to habitat conservation in those areas. This unity may be most effectively achieved when many members of the partnership participate in developing a community strategy for conservation.

Model-based Planning

Biological models that relate populations of priority species to their habitats and habitat management actions form the basis of regional biologically driven conservation strategies.

Models are applied using spatial data in a Geographic Information System (GIS). Assembling models at the start of the strategic planning process accomplishes two things:

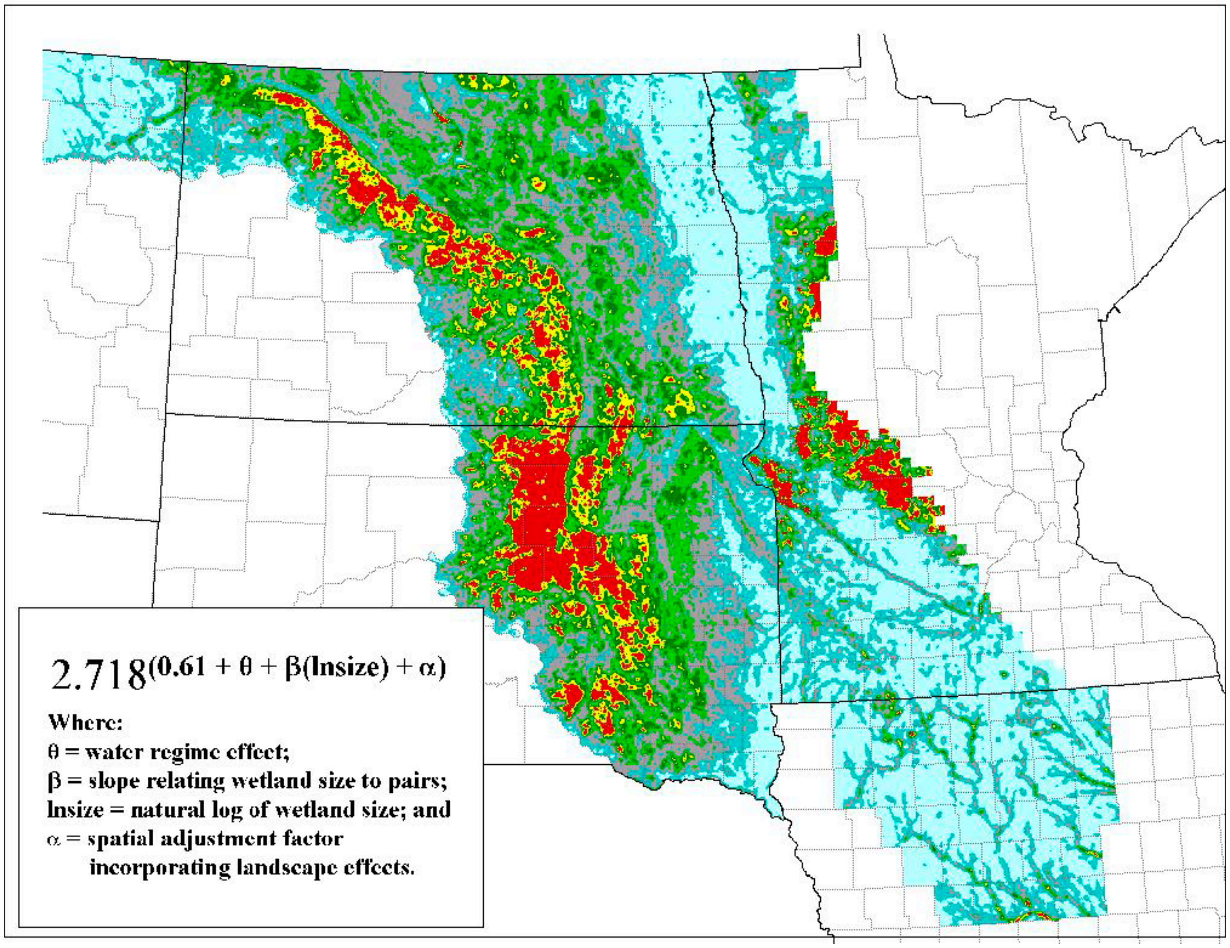
- it makes the assumptions underlying the management decision process explicit, and that, in turn, enables testing the most critical assumptions as hypotheses though research and evaluation; and
- it defines the spatial data (the data themes and resolution) required to develop planning tools. Since data acquisition often represents a large proportion of the total cost of planning, only spatial data required for model application should be acquired.

Often, models will be specific to waterfowl species and to management treatments (e.g., wetland protection, wetland restoration, reforestation). This is because different species may relate to habitats and landscapes differently, and because different costs and desired outcomes underlie the application of different management practices. A useful early step in the strategic planning process is to develop a matrix of priority species ("umbrella" or indicator species if possible) and management treatments, shading those matrix cells that correspond to an appropriate treatment for a species. Models may then be assembled for each shaded cell in the matrix.

The nature of biological models

Models are simply measurable statements about our understanding of how species relate to their habitats at site and landscape scales. There are two basic types of models. The first is empirical models: mathematical or statistical statements derived from research or monitoring data. Empirical models that are used to make explicit predictions about the magnitude of management population impacts are particularly desirable when working with costly management practices. In this situation, it may be warranted to develop new empirical models, especially where a high degree of uncertainty exists about waterfowl-habitat relationships. Because the time and cost of developing new empirical models may be significant, if empirical models that are believed to be reliable already exist, they should be used – with a commitment to evaluate their predictions. However, useful preexisting empirical models for planning at regional scales are rare. This is because researchers have often incorporated model parameters that can not be measured from data available for regional-scale planning (such as satellite imagery), or have developed models from data collected at local scales that fail to incorporate the full range of regional environmental conditions. Clearly, there need to be stronger relationships among managers and researchers. The strategic planning process is one way to bring the two groups together.

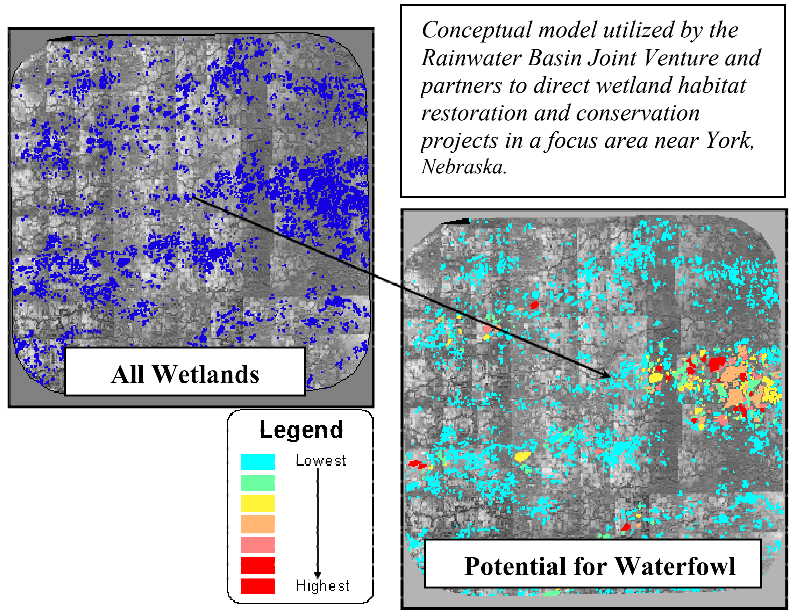
Figure 3. Empirical model-based predictions of nesting hen access to upland habitats



Important treatments among Prairie Pothole Joint Venture partners are the protection and restoration of grasslands for upland nesting waterfowl. Cost effectively managing grasslands for waterfowl benefits from an understanding of the distribution of nesting hens among landscapes that comprise the Joint Venture. This map, commonly referred to as a "Thunderstorm" map shows the predicted combined number of mallard, northern pintail gadwall, northern shoveler, and blue-winged teal hens that could nest within each 40 acre unit of the joint venture. It is based on a suite of empirical models that predicts the number of pairs of these species that will occur "on average" on each wetland in the Joint Venture, as well as empirical estimates of how far hens will travel from a wetland to an upland nest site. An example of a model predicting mallard pairs per wetland is shown. These models were developed from monitoring data of the distribution and abundance of waterfowl pairs collected across the Joint Venture each year. The warmer colors on the map indicate areas where a higher relative number of nesting hens may be benefited by the same management expenditure. Other considerations aside, conserving grasslands for waterfowl in these areas will be more cost-effective than elsewhere.

A lack of empirical models has sometimes led joint ventures to defer planning. The fallacy in this approach is that while empirical models are being developed - usually over a period of several to many years - management is proceeding without formal biological guidance. A satisfactory alternative is to start the planning process using conceptual models (aka heuristic models in that model performance is expected to improve through evaluation feedback). Conceptual models are general descriptive statements about species-habitat relationships that often, but not necessarily, include empirically-based parameter estimates. Such models draw on an awareness of past research results, but are constructed from a general understanding of how habitats affect a species. Conceptual models are fundamentally expert driven, and the planning process moves forward without waiting for the results from new research. This approach has been widely applied in conservation planning because it enables managers to proceed with conservation delivery in the face of imperfect information, but with the best biological guidance available. Systematically applying an informed set of assumptions about bird-habitat relationships often results in better management decisions than the haphazard application of management treatments.

Figure 4. Conceptual model-based assessment of relative wetland restoration benefits for waterfowl



Conceptual model utilized by the Rainwater Basin Joint Venture and partners to direct wetland habitat restoration and conservation projects in a focus area near York, Nebraska.

The Rainwater Basin Joint Venture recognized that a new planning paradigm was required to direct conservation actions. The goal was to target cost effective conservation actions at wetlands that provided the greatest benefit to migratory waterfowl. Due to the lack of research and technical information concerning waterfowl use of migration habitats, an empirical model was not a viable option. Natural resource professionals developed a conceptual model based on their best working knowledge of the Rainwater Basin. Several metrics were identified to assess the potential of wetlands for migrating waterfowl, including wetland density, disturbance factors, proximity to existing managed wetlands, proximity to other significant staging and foraging areas, and risk. Using GIS technology these metrics were applied to develop a biologically driven, spatially-explicit decision tool that targets wetlands with the greatest waterfowl potential. GIS technology also allowed wetlands to be paired with existing conservation programs that provided enhancement, restoration, and protection options to the eligible landowners. Research is ongoing in the Rainwater Basin to improve this model and to evaluate model assumptions.

Conceptual models are often fast and inexpensive to produce and apply. However, their assumptions and parameter estimates must be evaluated - particularly those that are most tenuous and that exert significant impacts on management decisions by causing managers to expend funds ineffectively or overlook management opportunities. That is, while data are not necessary for planning, they are necessary to evaluate model assumptions and to assess progress toward population goals.

Whether planning is based on empirical or conceptual models, it requires a commitment to monitoring and assessment in order to ascertain if the models are providing accurate predictions. Planning is part of an iterative cycle: planning, implementation, evaluation, and planning anew. Planning without evaluation and/or continuous plan updating breaks this cycle and diminishes management effectiveness.

Developing a Landscape Design

Priority waterfowl species generally exhibit differences in the ways they relate to sites, landscapes, and management actions across a joint venture. Furthermore, many joint ventures have adopted a goal of the integrated conservation of all birds. Similarities and differences in the ways priority species distribute themselves in space makes spatially-explicit biological planning and strategic landscape design essential for efficient attainment of a joint venture's population goals.

Ideally, joint ventures should pursue landscape designs that maximize aggregate species benefits without compromising the value of management to targeted species. For example, a joint venture may seek to design landscapes that provide high quality habitat for grassland non-game birds at the same time it pursues the greatest potential benefits for upland nesting waterfowl. In reality, it is rarely if ever possible to provide habitat at one point in space that maximizes benefits for the full suite of joint venture priority species.

Developing a landscape design requires that treatment priority areas for key species (that are identified in the biological planning process) be integrated in such a way that similarities in habitat use are accounted for, and that management conflicts among species are reconciled in ways that are satisfactory to the range of joint venture partners. Although an infinite number of landscape designs are possible, strategic landscape designs simply seek to accommodate the population goals of joint ventures with the smallest amount of habitat at the lowest possible cost.

Maps as spatially-explicit decision support tools – guidance to field managers

Accomplishing the goals of the Plan requires that joint ventures develop partnerships with field-level habitat managers. One thing joint ventures can bring to this partnership is maps that are useful for targeting management in pursuit of a pre-established landscape design. These maps that are the product of applying biological models to spatial data using GIS technology act as spatially-explicit decision support tools and are critical products of regional-scale strategic planning. However, it is important to emphasize that quality of biological models used to design landscapes and create maps determine the ultimate value of planning to management.

Maps are particularly effective communication tools for complex biological information because they enable managers to view the effects of complex species-habitat relationships in 2-dimensional space. This is particularly important when the models explaining these relations have >3 variables because few humans can manipulate 4 or 5 dimensional matrices (models based on 4 or 5 variables) in their minds.

Setting Habitat Objectives and Assessing Accomplishments

Conserving, restoring or managing habitats for one species will inevitably have a positive or adverse effect on other species. Thus calculating habitat objectives for an individual species is impractical under an overarching goal of conserving populations of multiple species. Despite this complexity, being able to say how much habitat is enough to attain joint venture population goals and national/continental population objectives, and being able to defend those figures, will be increasingly important as human demands for space and resources increase. Instead of calculating habitat objectives for individual priority species, joint venture habitat objectives should be calculated for habitat associations (e.g., emergent wetlands, bottomland hardwood forest, or grasslands). These habitat objectives will be based on the strategic landscape design that incorporates our understanding of similarities and differences in how priority species relate to sites, landscapes, and management actions.

As with any strategy, deviations are inevitable. Managers should have the liberty to take advantage of unexpected, but high quality opportunities when they arise (one benefit of a pre-established landscape design is to empower managers to say "No" in the face of external pressures when opportunities are not optimal). As we deviate from our landscape design, our habitat objectives also will change – as will they with refinements in the biological foundation for management. Thus, continuous updating of conservation strategies is important.

In addition to enabling development of landscape designs and explicit habitat objectives for the suite of priority species, biological models also enable assessment of management accomplishments in terms of the predicted consequences of individual management actions (e.g., a wetland restoration) for regional population carrying capacity. This is useful because population management is the ultimate goal of the Plan, and an accounting system based on population impacts helps partners move toward the attainment of the greatest population impacts at the lowest possible cost – a theme that is central to strategic conservation.

Lastly, it is important to note that while Plan population objectives are stepped down from a continental scale to joint ventures, habitat objectives, because they are based on landscapes designs founded on individual species-habitat relations that vary among ecoregions and seasons, are stepped up from joint ventures to national and continental scales. Consequently, the strategic growth of national and continental habitat conservation initiatives, like the Plan and others, is inseparably linked to a strong joint venture strategic planning capability.

Broadening the reach of waterfowl conservation

By applying these same principles of biological planning and landscape design to other environmental and socio-economic functions of habitats, such as, water quality enhancement, carbon sequestration, or flood-damage reduction, joint ventures may be able to effectively broaden their reach to non-traditional partners that often have vast impacts on our priority landscapes. By doing so it may be possible to capture the waterfowl habitat delivery potential of an array of government programs that seek these other benefits of habitats. Broadening their reach will require that joint ventures provide these potential partners with tools to help them help waterfowl. These tools will include spatially-explicit landscape designs and habitat objectives that are captured in credible biologically-driven conservation strategies.

Coping with Uncertainty in Biological Models

Every biological model, like every habitat management decision, simplifies and distorts waterfowl-habitat relationships. One advantage of model-based strategic planning is that it explicitly describes management decision processes and assumptions. After years of monitoring and research on North American waterfowl - the most studied group of wildlife in the world - there are still some fundamental gaps in the biological foundation. Model-based planning acts as a framework for identifying and filling these gaps because it is a systematic application of the biological foundation.

Uncertainty is, and will remain, a prevalent facet of the management and conservation of biological systems. In the face of making decisions when the outcomes are uncertain, wildlife conservation planners and managers have only two options. The first is to defer decisions until understanding of the managed system improves. Confronted with continued and possibly escalating anthropogenic and natural change in biological systems -- and with the likelihood that research will offer no short-term solution to management dilemmas -- this option is largely unpalatable and risks irreparable damage to the wildlife resource. The second, more prudent response is to base conservation resource allocations on current scientific understanding supplanted with educated guesses. Managers should proceed with conservation delivery while maintaining the explicit goal of reducing uncertainties and improving future conservation strategies. However, while the use of such conceptual models may be very useful in the planning process, it is not a long term solution to lack of empirical data. Monitoring and empirical data are ultimately needed in order to assess the success or failure of management actions.

There are several types of uncertainty that impact the ability of waterfowl managers to make optimal resource allocation decisions while implementing the Plan. First, planners are faced with an incomplete understanding of ecological processes that govern the influence of habitat, climate, and human disturbance (e.g., hunting pressure) on waterfowl survival and recruitment. Waterfowl harvest managers have termed this "structural uncertainty." There is structural uncertainty at every level of the strategic planning process. An example is the current lack of knowledge about the nature and form of density-dependence in waterfowl populations. A basic tenet of equilibrium theory is that at any given time, a given habitat has a population threshold, often termed its carrying capacity. When the population climbs above that carrying capacity, survival and/or recruitment are negatively affected. Presently, waterfowl managers have only a rudimentary understanding of the carrying capacity of individual habitat blocks. They know even less about how habitat carrying capacity, waterfowl abundance, and climatic forces interact to influence vital rates at regional and population-wide scales. This obviously compromises the manager's ability to provide an adequate area and distribution of habitats to minimize density dependent effects.

A second source of uncertainty in habitat conservation delivery has been characterized as "incomplete management control." Given the complexity of habitats utilized by waterfowl, and the myriad of site-specific geomorphologic and climatologic factors that influence the type and quality of habitats, it is impossible for managers to predict with certainty the outcome of particular habitat management activities. As a result, even if managers had perfect knowledge of the optimal habitat type and structure for a specific locale, achieving this desired result would remain as much an art as an exact science. Evaluations of specific management treatments, broadly replicated in space and time, will continue to enhance the capability to predict the habitat impacts of site-specific management actions. However, evaluations are unlikely to eliminate the element of surprise in managing waterfowl habitats.

Finally, resource limitations frequently mean that managers must sample waterfowl populations and habitat resources and estimate important parameters rather than directly measure these quantities. Uncertainty surrounding parameter estimates can not only hamper the effectiveness of model-based conservation decisions, but can also impede efforts to reduce structural uncertainties and to improve predictions about the effects of management actions.

Reducing uncertainty through implementation and evaluation

Assumptions made in the planning process must be explicitly stated. Only in that way can managers and planners devise robust conservation strategies and mechanisms. A robust conservation strategy is insensitive to particular management assumptions. To promote robust conservation strategies, planners and managers need to assess the potential influence of the uncertainties underlying their assumptions, with a high priority placed on those uncertainties that have potentially large implications.

Ultimately, managers assess the validity of the assumptions made during the planning process so they can confirm or improve their conservation strategies. There are three broad approaches to evaluating assumptions, with each having advantages in specific contexts.

The first approach to reducing uncertainty is largely passive. It may be most useful in learning about broad-scale ecological processes that affect the distribution and availability of habitats and, ultimately, waterfowl survival and recruitment. This approach is passive in that it relies on informative, natural variation in habitat availability and climatic conditions at large scales. Natural processes typically have the potential to affect waterfowl at broader spatial scales and with greater frequency than the habitat change brought about by intensive conservation effort. An exception might be rapid, large-scale landscape changes induced by governmental policies such as agricultural land conservation policies.

Managers need to take advantage of these large-scale, natural or human-induced variations to better understand how waterfowl respond to their environment. Using this passive approach, managers propose a suite of alternative models, which codify and encompass the range of some important management uncertainty. They then use monitoring programs to track changes in waterfowl demographics as well as pertinent habitat and environmental parameters. As model predictions are compared with observations, managers can evaluate the suitability of their competing models. Alternatively, a single model might be developed to best summarize current understanding, and the results of monitoring programs would be used to adjust this single best model over time.

A second approach to reducing planning uncertainties involves more active experimentation. Here, the process of management itself is viewed within an experimental context. This approach may be most applicable to evaluation of uncertainties associated with a particular management treatment or to a suite of treatments applied to a landscape. Managers proceed with habitat conservation with the dual objectives of meeting conservation objectives as well as reducing uncertainty to improve future decisions. Again, a model suite that incorporates the range of some important uncertainty is necessary, as are population and environmental monitoring programs to measure response to habitat manipulations.

Lastly, directed research will continue to be an important means of testing planning assumptions and reducing uncertainties. Both of the first two approaches are interrelated with, and dependent upon, directed research. It's likely that both retrospective analyses and observational studies will contribute to the development of useful planning models and to the specification of monitoring protocols. Where lack of baseline data inhibits the development of models for conservation planning, directed studies may be the most efficient means to develop basic life history, range and movement, resource availability, and resource utilization databases. In addition, focused research may be the most practical means to parameterize conceptual models in order to develop more useful empirical models of habitat-population interactions.

Summary

The fundamental challenge facing waterfowl conservation planners is the development of cohesive regional conservation strategies that will lead to achievement of the Plan's waterfowl population objectives. This challenge is most effectively addressed through iterative cycles of planning, implementation, and evaluation, as phases in the conservation delivery process. As joint ventures have matured, they have increasingly invested both in strategic planning predicated on reliable biological information and in improving the quality of biological information through evaluation and research.

Biologically driven strategic conservation involves the development and application of empirical or conceptual models that describe waterfowl response to landscape conditions. Model-based biological planning is the foundation for developing efficient landscape designs that incorporate similarities and differences in the ways multiple priority species relate to habitats and management. From these landscape designs, objectives for habitat conservation may be developed that are adequate to support regional waterfowl population levels needed to attain continental population objectives.

Models, unfortunately, are developed with an imperfect understanding of the processes that limit and regulate waterfowl populations and, also, with an inability to precisely predict the results of a habitat management action. It is important that assumptions made during the planning process be explicitly defined in order to assess the robustness of conservation strategies to uncertainty, and to evaluate the validity of assumptions that have large implications for choosing an optimal conservation strategy.

As the results of evaluations become available, planning models may be adjusted to reflect new understanding and conservation strategies revised based on improved model predictions. Where multiple alternative models have been described, conservation strategies can be adjusted to reflect growing confidence in a particular model or subset of models, and the cycle of planning, implementing, and evaluating repeats. The complexity of ecological systems and the dynamic nature of migratory waterfowl and their habitats will necessitate a long-term perspective and institutional patience as managers pursue an improved biological basis for waterfowl habitat conservation actions.

Appendix B: Species Prioritization Analysis

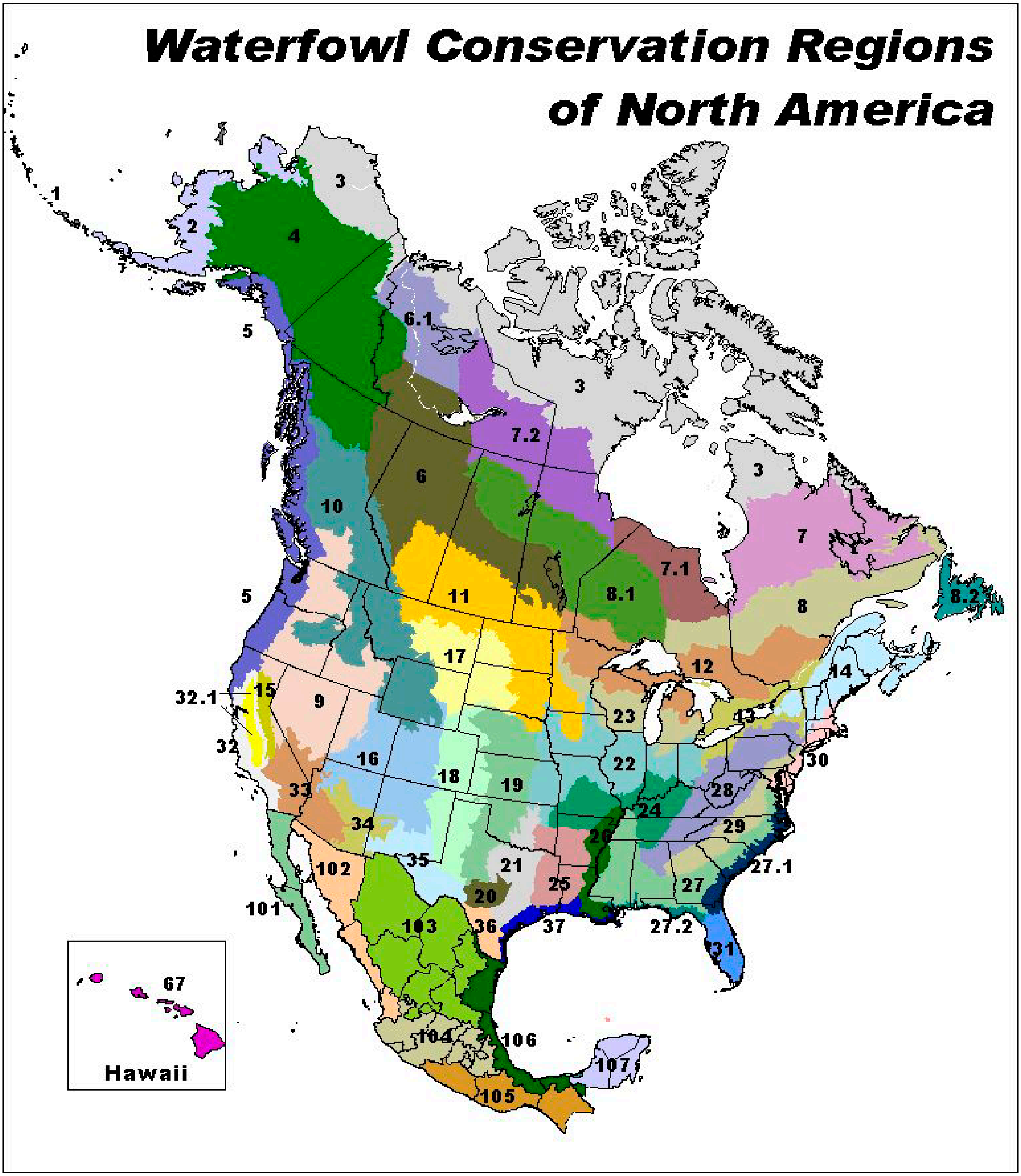
Species prioritization has recently been the subject of considerable attention and vigorous debate. At its core, the selection of priority species is a subjective process with individuals subjectively selecting their own prioritization criteria. Still, prioritization may provide useful programmatic guidance at regional and continental scales.

Plan partners, including the NSST, joint ventures, and biologists from Canada, Mexico and the U.S., have prioritized species based on the reasons that North Americans value waterfowl: socio-economic importance, and population trend or vulnerability to population decline. These criteria stem from a societal ethic that does not casually accept the extirpation or extinction of species, and from a tradition of waterfowl hunting, which requires that those species common enough to support a significant sport or subsistence harvest remain abundant.

Species priorities for the Plan are a necessary precursor to the strategic planning that underwrites joint venture implementation plans (see Appendix A). To be most useful, priorities must be identified at continental and regional scales. At regional scales, they should conform to the geographic units that are used for planning. The NSST believes that planning and conservation delivery are most efficient when tailored to ecological regions within which waterfowl communities, habitats, species-habitat relationships, and threats to habitats are relatively homogeneous. Consequently, we modified ecological units known as Bird Conservation Regions to better reflect the abundance and diversity of waterfowl across North America. These Waterfowl Conservation Regions (WCRs) are the Plan's geographic unit for prioritization at the regional scale. WCRs cover the continent, yet they are smaller than flyways and most joint ventures, and more homogeneous than flyways, and most joint ventures and states, making them more tractable planning units (Figure Z).

Despite these advantages of using WCRs, they are not perfect for prioritization or for depicting areas of critical importance to continental waterfowl populations. Particularly in more arid parts of the continent, considerable heterogeneity within WCRs exists among landscapes and their potential for waterfowl conservation. The Plan Committee and the NSST anticipate that joint venture strategic planning will account for this heterogeneity, and more spatially-refined information, when available, should always take precedence over the coarse, continental-scale assessment reported herein (see Appendix A). The Plan community, represented by the NSST, will capture these improvements in regular updates of prioritization products as one aspect of fulfilling the promise of strengthening the biological foundation for waterfowl conservation.

Figure 5.


Waterfowl Conservation Regions
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Prioritization Methods

Continental Species Prioritization

Ducks -- Continental prioritization of ducks is based on two factors: continental population trend and combined continental sport and subsistence harvest data. Population trend (1970-2002) was assessed using data from the Aerial Breeding Population and Habitat Survey (May survey) for the full period of record. Expert opinion determined population trend for species that are poorly surveyed by the May survey, for example, sea ducks. Ultimately, population trend was defined as Increasing, Stable, Unknown, or Decreasing – with Unknown and Decreasing trends weighted equally for prioritization. "Gadwall probably represents the epitome of a true Prairie Pothole Region duck, staying true to the area under almost any conditions. When the last pothole is drained and the last grass plowed under, all other duck species will still be around, but not the lowly gadwall" – Ron Reynolds, USFWS

For some species, long-term population trend and historic harvest data do not tell the whole story in assessing species priority. Gadwalls are an example. An increasing trend since the 1970s and a moderate harvest importance identify gadwalls as a Moderate continental priority for the Plan. Yet beginning in 1995, the harvest of gadwalls nearly doubled over that of the previous several years, and since 1997 breeding populations have declined every year – from 4 million in 1997 to 2.2 million in 2002. Gadwall breeding populations are tied to the Prairie Pothole Region – they do not "over fly" to the north during drought years in the region. It is unknown if this declining trend will persist or is just a "bump in the road" for what has been a waterfowl conservation "bright spot". Nevertheless, the combination of deteriorating habitat conditions across the Prairie Pothole Region and sustained high harvest warrants close scrutiny for this species in the future. This underscores the need for the Plan community to regularly update species and geographic priorities.

Data from the US Fish and Wildlife Service (USFWS) Waterfowl Parts Survey, 1980-1999, was used to estimate average annual sport harvest for the US. The Canadian Wildlife Service (CWS) provided harvest data for Canada. Mexican sport harvest was assumed to be inconsequential to continental waterfowl populations (Kramer et al., 1995, *Waterfowl Harvest and Hunter Activity in Mexico*, Trans 60th No. Am. Wildl. & Nat. Resourc. Conf.) Finally, a variety of short-term surveys helped estimate aboriginal subsistence harvest of various species and the Greenland harvest of king and common eiders. Using these data, we estimated the proportion each species comprised of the overall mean annual continental sport and subsistence harvest. A high harvest species comprised >15% of the overall mean annual harvest (that is, mallards). A moderate harvest species comprised 1-14% of the mean annual harvest, and low harvest species comprised < 1%.

Continental priority for ducks was assigned using the following matrix and is listed for each species in Table 1.

Continental Duck Species Priority

Importance in Harvest	Population Trend			
	Decreasing	Unknown	Stable	Increasing
High	Highest	Highest	High	Mod High
Moderate	High	High	Mod High	Moderate
Low	Mod High	Mod High	Moderate	Mod Low

Geese and Swans – Unlike ducks, explicit population objectives have been established for most managed populations of geese and swans. Moreover, intensive management of goose populations tends to insure that increasing populations of geese that are above objective levels are more liberally harvested than declining or stable populations that are at or below objective size, resulting in relatively little separation among populations using the continental prioritization process described for ducks. Consequently, for geese and swans, continental prioritization was based on a matrix of population trend (1993-2002) and deviation from Plan population objective (2000-2002) as follows. The results are reported in Table 1.

Continental Goose and Swan Species Priority

Population Size Relative to Objective	Population Trend			
	Decreasing	Unknown	Stable	Increasing
Below	Highest	Highest	High	Mod High
Unknown	Highest	Expert Opinion	Mod High	Moderate
At Objective	High	Mod High	Moderate	Mod Low
Above	Moderate	Mod Low	Mod Low	Expert Opinion

Duck Species	AOU#	Trend 1970-2003	DS[1]	Regular Harvest 1980-1999	Subsistence Harvest[2]	% Total Harvest	Harvest Importance	Continental Priority
Mallard	1320	Stable	a	4,623,156	100,000	35.3	High	High
American Black Duck	1330	Decreasing	a	439,955	30,000	3.5	Moderate	High
Lesser Scaup	1490	Decreasing	a	383,513	14,000	3	Moderate	High
Northern Pintail	1430	Decreasing	a	594,799	42,000	4.8	Moderate	High
Common Eider	1590	Decreasing	c	51,947	156,920[3]	1.6	Moderate	High
Blue-winged and Cinnamon Teal	1400-1410	Stable	a	741,007	12,000	5.6	Moderate	Mod High
American Wigeon	1370	Stable	a	645,443	7,000	4.9	Moderate	Mod High
Canvasback	1470	Stable	a	72,101	2,000[4]	0.6	Low	Mod High
Redhead	1460	Stable	a	144,470	4,000	1.1	Moderate	Mod High
Common Goldeneye	1510	Stable	c	131,075	13,634	1	Moderate	Mod High
Long-tailed Duck	1540	Decreasing	c	30,560	16,341	0.4	Low	Mod High
King Eider	1620	Decreasing	c	2,036	27,469[5]	0	Low	Mod High
Steller's Eider	1570	Decreasing	c	91	270	0	Low	Mod High/*High*[6a,7]
Spectacled Eider	1580	Decreasing	c	0	247	0	Low	Mod High/*High*[6a,7]
Black Scoter	1630	Decreasing	c	19,099	8,228	0.2	Low	Mod High
White-winged Scoter	1650	Decreasing	c	28,205	2,954	0.2	Low	Mod High
Surf Scoter	1660	Decreasing	c	32,923	831	0.3	Low	Mod High
Muscovy Duck		Decreasing	d	0	unestimated	0	Low	Mod High/*High*[6b,7]
Masked Duck	1680	Unknown	d	0	unestimated	0	Low	Mod High[7]
Green-winged Teal	1390	Increasing	a	1,386,215	30,000	10.6	Moderate	Moderate
Wood Duck	1440	Increasing	b	1,203,660	15,000	9.1	Moderate	Moderate
Gadwall	1350	Increasing	a	853,041	7,000	6.4	Moderate	Moderate
Northern Shoveler	1420	Increasing	a	373,964	4,000	2.8	Moderate	Moderate
Ring-necked Duck	1500	Increasing	a	506,049	18,000	3.9	Moderate	Moderate
Greater Scaup	1480	Stable	a	82,317	3,000	0.6	Low	Moderate
Bufflehead	1530	Increasing	a	168,682	7,546	1.3	Moderate	Moderate

Western Barrow's Goldeneye	1520	Stable	c	8,318	884	0.1	Low	Moderate
Eastern Barrow's Goldeneye	1520	Stable	c	3,338	355	0	Low	Moderate/*High*[8]
Western Harlequin Duck	1550	Stable	c	1,898	1,032	0	Low	Moderate
Eastern Harlequin Duck	1550	Stable	c	2,183	1,186	0	Low	Moderate/*High*[8]
Mottled Duck	1340	Stable	e	78,027	0	0.6	Low	Moderate
Hawaiian Duck	1321	Stable	f	0	0	0	Low	Moderate/*High*[6a,7]
Laysan Duck	1322	Stable	f	0	0	0	Low	Moderate/*High*[6a,7]
Fulvous Whistling Duck	1780	Increasing	d	1,357	unestimated	0	Low	Mod Low
Black-bellied Whistling Duck	1770	Increasing	d	1,216	unestimated	0	Low	Mod Low
Mexican Duck	1331	Increasing	d	0	unestimated	0	Low	Mod Low[7]
Ruddy Duck	1670	Increasing	a	44,966	1,000	0.3	Low	Mod Low
Common Merganser	1290	Increasing	c	37,070	7,000	0.3	Low	Mod Low
Red-breasted Merganser	1300	Increasing	c	31,346	2,000	0.2	Low	Mod Low
Hooded Merganser	1310	Increasing	c	86,083	6,000	0.7	Low	Mod Low

	AOU#	Trend 1993-2002	Population Size 2000-2002	Population Objective	Continental Priority
Canada Goose Populations	1720				
Atlantic		Increasing	134,900	175,000[9]	High
Lesser		Unknown	Unknown	Not Set	High
Dusky		Stable	17,300	Avoid Listing	High
Southern James Bay		Stable	89,400	100,000[11]	High
Cackling		Stable	181,700	250,000[10]	High

Aleutian		Increasing	33,400	40,000[10]	Mod High
North Atlantic		Unknown	Unknown	Not Set	Mod High
Vancouver		Unknown	Unknown	Not Set	Moderate
Taverner's		Unknown	Unknown	Not Set	Moderate
Mississippi Valley		Stable	589,600	375,000[11]	Moderate
Shortgrass Prairie		Decreasing	175,000	150,000[10]	Moderate
Pacific		Stable	Unknown	Not Set	Moderate
Rocky Mountain		Increasing	162,229	117,100[10]	Mod Low
Eastern Prairie		Stable	235,600	200,000[11]	Mod Low
Tallgrass Prairie		Stable	316,500	250,000[10]	Mod Low
Atlantic Flyway Resident		Increasing	997,700	650,000[11]	Above Objective
Mississippi Flyway Giant		Increasing	1,442,900	1,000,000[11]	Above Objective
Western Prairie/Great Plains		Increasing	662,600	285,000[10]	Above Objective
Hi-Line		Increasing	246,900	80,000[10]	Above Objective
Lesser Snow Goose Populations	1690				
Wrangel Island		Increasing	102,500	120,000[11]	Mod High
Western Central Flyway		Stable	114,400	110,000[10]	Moderate
Mid-continent		Stable	2,478,200	1,000,000[10]	Above Objective[12]
Western Arctic		Increasing	486,000	200,000[11]	Above Objective
Greater Snow Goose	1691	Increasing	763,500	500,000[13]	Above Objective[12]
Ross's Goose	1700	Increasing	619,000	100,000[11]	Above Objective
Greater White-fronted Goose	1710				
Mid-continent		Stable	914,300	600,000[14]	Mod Low
Pacific Flyway		Increasing	381,200	300,000[10]	Mod Low
Tule White-fronted Goose		Stable	5,500	10,000[10]	High

Pacific Brant	1740	Stable	132,000	150,000[10]	High
Western High Arctic Brant		Unknown	Unknown	12,000	High
Eastern High Arctic Brant		Stable	20,000	Not Set	Mod High
Atlantic Brant	1730	Stable	161,400	124,000[10]	Mod Low
Emperor Goose	1760	Stable	68,600	150,000[11]	High[7]
Hawaiian Goose	1751	Stable	1,175	2,800	High[6a,7]
Tundra Swan Populations	1800				
Eastern		Increasing	101,800	80,000[10]	Mod Low
Western		Stable	79,500	60,000[10]	Mod Low
Trumpeter Swan Populations	1810				
Rocky Mountain		Increasing	3,666 (9.1%)	5% Ann. Growth	High
Interior		Increasing	2,430	2,000	Moderate[15]
Pacific Coast		Increasing	17,551	13,000[14]	Mod Low
Mute Swan	1782	Increasing	20,000	Not Set	Above Objective[7]

[1]Data Source (Trend): a - May Survey; b - Breeding Bird Survey; c - Sea Duck Joint Venture; d - SEMARNAT; e - Gulf Coast Joint Venture; f - Pacific Coast Joint Venture
[2]Generally believed to be biased low because of under reporting and unsurveyed areas

[3]Includes an estimated 80,000 bird harvest in Greenland
[4]Sport harvest does not reflect hunter valuation and is depressed because of restrictive regulations during the period evaluated

[5]Includes an estimated 5,000 bird harvest in Greenland

[6]Listed as Threatened or Endangered in (a) the U.S.; (b) Mexico- Conservation plans developed under authority of national threatened and endangered species legislation

[7]Species that do not routinely cross jurisdictional boundaries of Canada, the U.S., or Mexico. There is no Plan expectation of conservation by non-jurisdictional entities
[8]Species of Special Concern in Canada - Conservation plans developed under authority of national threatened and endangered species legislation

[9]Breeding pair objective. [10]Winter index objective.
[11]Total breeding population objective.

[12]Designated as an overpopulation concern by Canada and the U.S.

[14]Autumn index objective. [15]Based on expert opinion

Waterfowl Conservation Region Species Prioritization

The 1986 Plan included a map of areas of major concern to North American waterfowl. This map reflected the considerable expertise of the waterfowl conservation community, based on lifetimes of experience with breeding and nonbreeding waterfowl. The conservation of habitats in those priority areas is as important today as it was in 1986. Nevertheless, as the number of joint ventures has expanded, and as individual joint ventures have grown beyond the ecologically-based regions envisioned in 1986, the Plan Committee and the NSST believe it is prudent to provide guidance from a continental perspective that can be used by managers throughout North America. For this purpose, the NSST developed priority species lists for each WCR to help Plan partners targets their conservation efforts on the species, in the appropriate phase of their annual cycle, with the greatest conservation need in that WCR.

Addressing persistent challenges related to decisions about where and how to most efficiently attain the goals of the Plan requires *a priori* information about the distribution and abundance of waterfowl. Despite the fact that North American waterfowl are more effectively surveyed each year than any other group of birds, no single survey, during either breeding or nonbreeding seasons, adequately assesses distribution of ducks or geese across the continent-wide extent of the Plan. This poses challenges for the strategic conservation of habitats across North America, and requires that data from diverse surveys be merged to depict these patterns of seasonal distribution and abundance. Yet there are practical limits to the number of survey databases that can be combined in a systematic assessment, and there are limits in the spatial resolution of data from the widespread surveys that are most useful for continental assessment. Inevitably, these limitations must affect the results of species prioritization at regional scales. Consequently, lists of priority species presented in Tables 2 and 3 are not prescriptions for conservation. They are merely a starting point for joint ventures planning at regional scales. It is hoped that these lists will help joint ventures make conservation decisions based on a better understanding of their regional significance – in a continental context – to the full suite of North American waterfowl.

Geographic Importance for Breeding Ducks – Data on breeding duck distribution from the May breeding survey and Breeding Bird Survey (BBS), 1980-1999, and perceived threats to a species' habitat were used for WCR-scale species prioritization. Mean annual May survey stratum estimates were assigned to WCRs in the traditional and eastern survey areas by the WCR that encompassed the majority of a stratum. In a few cases, two WCRs comprised nearly equal areas of survey strata. In these cases, one half the mean stratum population estimate was assigned to each WCR, as if species were uniformly distributed within the stratum. For areas of the US and southwestern Canada that are not covered by the May survey, BBS data were used. BBS estimates were generated using an inverse distance interpolation (estimates from the 15 nearest BBS routes) to assess the relative abundance of species across the US and southern Canada in a digital data layer (GIS coverage). Each pixel in the interpolated coverage was assigned to a WCR.

Percent of the surveyed population and the relative density of a species breeding in a WCR were derived from relative abundance estimates from the May survey and BBS. Percent and relative density were ranked as High, Moderately High, Moderately Low, or Low. In areas of North America not covered by the May survey or BBS, WCRs received categorical ranks based on expert opinion and published literature.

The NSST developed scores for threats to habitats within WCRs using the following criteria:

Very Low -	Expected future conditions better than historic conditions - possibly becoming a problem species because of habitat enhancement.
Low -	Expected future conditions similar to historic conditions - no known threats.
Moderate -	Slight to moderate decline in future habitat abundance or quality but current conditions similar to historic conditions; or, future conditions expected to be stable but significant habitat losses have already occurred.
Moderately High -	Severe past or predicted deterioration or decline in habitat quality or availability.
High -	Extreme past or predicted deterioration or decline in habitat quality or availability - species in danger of regional extirpation.

In order to determine the geographic importance of a WCR to a species, the categorical assessments of percent, relative density, and threats to habitat were weighted equally. WCRs that were of Low importance to a species were subsequently deleted from Tables 2 and 3 because they represented ecological regions in which the species occurred infrequently or in very low relative abundance.

Geographic Importance for Nonbreeding Ducks – Procedures used to assess the importance of WCRs for nonbreeding species were similar to those used for breeding species, except U.S. and Mexican Midwinter Inventory (MWI) data were used, and assessments for Canada were based on expert input. U.S. counties and Mexican MWI survey sites were assigned to WCRs to assess the percent of a species wintering in a BCR and to estimate its density.

In consideration of the importance of mid-latitude migration habitat during the nonbreeding period, county-level mean harvest estimates (1980-1999) from the Parts Survey database were treated as an index to distribution during fall migration. The aggregate total mean harvest of counties assigned to a WCR was used to calculate the percent of harvest occurring in a WCR. Categorical percent, density (from MWI data), harvest, and threats to nonbreeding habitat were used to assess geographic importance of WCRs for a species during the nonbreeding period. Geographic importance and continental priority rank were used to assess conservation need of a species in a particular WCR using the matrix described above.

No spatially-extensive data sets were available to assess geographic importance for molting or during spring migration. Major concentration areas during these periods, based on published sources and expert opinion, are incorporated into the map of *"Areas of Continental Significance* *to North American Waterfowl"*. Conservation of these habitats is particularly important, and may be highly efficient because of the number of birds that can be affected in one area.

Breeding and Nonbreeding Geese and Swans – The importance of specific WCRs to breeding and nonbreeding geese and swans was based on information provided by Canadian, U.S. and Mexican waterfowl biologists, including members of the Arctic Goose Joint Venture Technical Committee. Their extensive understanding of how managed populations of geese and swans distribute themselves seasonally made this approach desirable in that it enabled incorporation of major spring and fall migration habitats into the assessment of nonbreeding geographic importance, whereas harvest data for managed populations of geese and swans is unavailable.

Pelagic Conservation Regions – Spectacled and Common Eiders make limited use of terrestrial WCRs during their annual cycle. Many other species of sea ducks occupy offshore areas nearly exclusively during the nonbreeding season. For these species, pelagic conservation regions (PCRs) are listed in Tables 2 and 3, although the adjacent terrestrial WCR also is listed. PCRs were adopted from the North American Waterbird Conservation Plan[6]

Assessing Conservation Need

The Plan Committee and the NSST believe that the conservation need of a species in a particular WCR is a function of the geographic importance of the WCR for that species and the species overall continental priority status for the Plan. Conservation need may be interpreted as the need for habitat conservation and/or the need for monitoring. A designation of high conservation need for a species within a particular WCR does not necessary imply a great need for habitat conservation. To determine conservation need, geographic importance ranks were combined with continental priority ranks using the following matrix. Conservation need is reported in tables 2 and 3 next to geographic importance.

Regional Conservation Need

Geographic Importance	Continental Priority			
	High	Moderately High	Moderate	Moderately Low or Above Objective
High	Highest	High	High	High
Mod High	High	Mod High	Mod High	Moderate
Mod Low	Moderate	Mod Low	Mod Low	Low

[6] Kushlan, J.A. et. al. 2002. *Waterbird Conservation for the America::The North American Waterbird Conservation Plan, www.waterbirdconservation.org*

Cautionary Notes about Prioritization

Species prioritization within WCRs **does not** imply that harvest regulation should be used to directly manage survival at this scale. The aggregate effects of the entire annual cycle throughout their annual range determine waterfowl demographics.

Finally, there may be local **"hotspots"** that are not characteristic of overall WCRs. Management of these areas may be an imperative, even if the WCR is otherwise of moderately low importance for a species. Prioritization based on continental data sets should never supercede sound biological planning at regional scales. Joint ventures and others with better information about the importance of proposed project areas should always receive due consideration. The Plan Committee expects joint ventures to identify the benefits of habitat management in these local priority areas and to communicate the importance of these areas to others outside the joint venture. One result of regional biological planning is the identification of these "hotspots" as joint venture focus areas, where appropriate.

Combined prioritization for breeding and nonbreeding ducks (empty cells indicate low conservation need or absence).

	Pelagic WCRs							
WCR	Breeding	NonBreeding	Species/Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
1		1012	**Common Eider**	HIGH			MOD HIGH	**HIGH**
1			**Northern Pintail**	HIGH	MOD LOW	**MODERATE**		
1		1012	**Black Scoter**	MOD HIGH			MOD LOW	**MOD LOW**
1		1012	**King Eider**	MOD HIGH			MOD LOW	**MOD LOW**
1		1012	**Long-tailed Duck**	MOD HIGH			MOD HIGH	**MOD HIGH**
1		1012	**Spectacled Eider**	MOD HIGH			MOD HIGH	**MOD HIGH**
1		1012	**Steller's Eider**	MOD HIGH			HIGH	**HIGH**
1		1012	**Surf Scoter**	MOD HIGH			MOD LOW	**MOD LOW**
1		1012	**White-winged Scoter**	MOD HIGH			MOD LOW	**MOD LOW**
1		1012	**Harlequin Duck**	MODERATE	MOD LOW	**MOD LOW**	HIGH	**HIGH**
2	1012	1012	**Common Eider**	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
2			**Mallard**	HIGH	MOD LOW	**MODERATE**		
2			**Northern Pintail**	HIGH	HIGH	**HIGHEST**		
2			**American Wigeon**	MOD HIGH	MOD HIGH	**MOD HIGH**		
2		1012	**Black Scoter**	MOD HIGH	HIGH	**HIGH**	MOD HIGH	**MOD HIGH**
2			**Canvasback**	MOD HIGH	MOD LOW	**MOD LOW**		
2			**Common Goldeneye**	MOD HIGH			MOD LOW	**MOD LOW**
2		1012	**King Eider**	MOD HIGH			HIGH	**HIGH**
2		1012	**Long-tailed Duck**	MOD HIGH	HIGH	**HIGH**	MOD HIGH	**MOD HIGH**
2	1012	1012	**Spectacled Eider**	MOD HIGH	HIGH	**HIGH**	HIGH	**HIGH**
2		1012	**Steller's Eider**	MOD HIGH	HIGH	**HIGH**	HIGH	**HIGH**
2		1012	**Surf Scoter**	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
2		1012	**White-winged Scoter**	MOD HIGH			MOD LOW	**MOD LOW**
2			**Barrow's Goldeneye**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
2			**Bufflehead**	MODERATE	MOD LOW	**MOD LOW**		
2			**Gadwall**	MODERATE	MOD LOW	**MOD LOW**		
2			**Greater Scaup**	MODERATE	MOD HIGH	**MOD HIGH**		
2			**Green-winged Teal**	MODERATE	MOD HIGH	**MOD HIGH**		
2		1012	**Harlequin Duck**	MODERATE	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
2			**Northern Shoveler**	MODERATE	MOD HIGH	**MOD HIGH**		
2			**Ring-necked Duck**	MODERATE	MOD LOW	**MOD LOW**		

3	1001/1015	1001	**Common Eider**	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
	Pelagic WCRs			**Continental**	**Breeding**	**Breeding**	**Nonbreeding**	**Nonbreeding**
WCR	**Breeding**	**NonBreeding**	**Species/Population**	**Priority**	**Importance**	**Need**	**Importance**	**Need**
3			**Northern Pintail**	HIGH	MOD HIGH	**HIGH**	MOD LOW	**MODERATE**
3			**Black Scoter**	MOD HIGH	MOD LOW	**MOD LOW**		
3			**Common Goldeneye**	MOD HIGH	MOD HIGH	**MOD HIGH**		
3			**King Eider**	MOD HIGH	HIGH	**HIGH**		
3			**Long-tailed Duck**	MOD HIGH	HIGH	**HIGH**		
3	1001/1015	1001	**Spectacled Eider**	MOD HIGH	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
3			**Steller's Eider**	MOD HIGH	MOD HIGH	**MOD HIGH**		
3			**Surf Scoter**	MOD HIGH	MOD HIGH	**MOD HIGH**		
3			**White-winged Scoter**	MOD HIGH	MOD LOW	**MOD LOW**		
3			**Harlequin Duck**	MODERATE	MOD HIGH	**MOD HIGH**		
4			**Lesser Scaup**	HIGH	MOD HIGH	**HIGH**		
4			**Mallard**	HIGH	MOD HIGH	**HIGH**	MOD LOW	**MODERATE**
4			**Northern Pintail**	HIGH	MOD HIGH	**HIGH**		
4			**American Wigeon**	MOD HIGH	HIGH	**HIGH**		
4			**Black Scoter**	MOD HIGH	MOD LOW	**MOD LOW**		
4			**Canvasback**	MOD HIGH	MOD HIGH	**MOD HIGH**		
4			**Common Goldeneye**	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
4			**Long-tailed Duck**	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
4			**Redhead**	MOD HIGH	MOD LOW	**MOD LOW**		
4			**Surf Scoter**	MOD HIGH	HIGH	**HIGH**		
4			**White-winged Scoter**	MOD HIGH	MOD HIGH	**MOD HIGH**		
4			**Barrow's Goldeneye**	MODERATE	MOD HIGH	**MOD HIGH**		
4			**Bufflehead**	MODERATE	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
4			**Greater Scaup**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
4			**Green-winged Teal**	MODERATE	MOD HIGH	**MOD HIGH**		
4			**Harlequin Duck**	MODERATE	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
4			**Northern Shoveler**	MODERATE	MOD HIGH	**MOD HIGH**		
4			**Ring-necked Duck**	MODERATE	MOD LOW	**MOD LOW**		
5		1011	**Common Eider**	HIGH			MOD LOW	**MODERATE**
5			**Lesser Scaup**	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
5			**Mallard**	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
5			**Northern Pintail**	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
5			**American Wigeon**	MOD HIGH	MOD LOW	**MOD LOW**	HIGH	**HIGH**
5		1010/1011	**Black Scoter**	MOD HIGH			MOD HIGH	**MOD HIGH**

5			**Blue-winged/CinnamonTeal**	MOD HIGH	MOD HIGH	**MOD HIGH**		
	Pelagic WCRs			**Continental**	**Breeding**	**Breeding**	**Nonbreeding**	**Nonbreeding**
WCR	**Breeding**	**NonBreeding**	**Species/Population**	**Priority**	**Importance**	**Need**	**Importance**	**Need**
5			**Canvasback**	MOD HIGH			MOD HIGH	**MOD HIGH**
5			**Common Goldeneye**	MOD HIGH	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
5		1010/1011	**Surf Scoter**	MOD HIGH			HIGH	**HIGH**
5		1010/1011	**White-winged Scoter**	MOD HIGH			HIGH	**HIGH**
5			**Barrow's Goldeneye**	MODERATE			HIGH	**HIGH**
5			**Bufflehead**	MODERATE	MOD LOW	**MOD LOW**	HIGH	**HIGH**
5			**Gadwall**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
5			**Greater Scaup**	MODERATE	MOD LOW	**MOD LOW**	HIGH	**HIGH**
5			**Green-winged Teal**	MODERATE	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
5		1010/1011	**Harlequin Duck**	MODERATE	MOD HIGH	**MOD HIGH**	HIGH	**HIGH**
5			**Northern Shoveler**	MODERATE	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
5			**Ring-necked Duck**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
5			**Wood Duck**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
5			**Red-breasted Merganser**	MOD LOW			MOD HIGH	**MODERATE**
5			**Ruddy Duck**	MOD LOW			MOD HIGH	**MODERATE**
6			**Lesser Scaup**	HIGH	HIGH	**HIGHEST**		
6			**Mallard**	HIGH	MOD HIGH	**HIGH**		
6			**Northern Pintail**	HIGH	MOD HIGH	**HIGH**		
6			**American Wigeon**	MOD HIGH	HIGH	**HIGH**		
6			**Blue-winged Teal**	MOD HIGH	MOD HIGH	**MOD HIGH**		
6			**Canvasback**	MOD HIGH	MOD HIGH	**MOD HIGH**		
6			**Common Goldeneye**	MOD HIGH	HIGH	**HIGH**	MOD LOW	**MOD LOW**
6			**Long-tailed Duck**	MOD HIGH	MOD LOW	**MOD LOW**		
6			**Redhead**	MOD HIGH	MOD HIGH	**MOD HIGH**		
6			**Surf Scoter**	MOD HIGH	MOD HIGH	**MOD HIGH**		
6			**White-winged Scoter**	MOD HIGH	HIGH	**HIGH**		
6			**Bufflehead**	MODERATE	HIGH	**HIGH**		
6			**Gadwall**	MODERATE	MOD HIGH	**MOD HIGH**		
6			**Green-winged Teal**	MODERATE	HIGH	**HIGH**		
6			**Northern Shoveler**	MODERATE	MOD HIGH	**MOD HIGH**		
6			**Ring-necked Duck**	MODERATE	HIGH	**HIGH**		
6			**Common Merganser**	MOD LOW	MOD HIGH	**MODERATE**		
6			**Ruddy Duck**	MOD LOW	MOD HIGH	**MODERATE**		
6.1			**Lesser Scaup**	HIGH	HIGH	**HIGHEST**		

6.1			**Mallard**	HIGH	MOD HIGH	**HIGH**		
	Pelagic WCRs			**Continental**	**Breeding**	**Breeding**	**Nonbreeding**	**Nonbreeding**
WCR	**Breeding**	**NonBreeding**	**Species/Population**	**Priority**	**Importance**	**Need**	**Importance**	**Need**
6.1			**Northern Pintail**	HIGH	MOD HIGH	**HIGH**		
6.1			**American Wigeon**	MOD HIGH	MOD HIGH	**MOD HIGH**		
6.1			**Canvasback**	MOD HIGH	MOD LOW	**MOD LOW**		
6.1			**Common Goldeneye**	MOD HIGH	MOD LOW	**MOD LOW**		
6.1			**Long-tailed Duck**	MOD HIGH	MOD HIGH	**MOD HIGH**		
6.1			**Redhead**	MOD HIGH	MOD LOW	**MOD LOW**		
6.1			**Surf Scoter**	MOD HIGH	MOD HIGH	**MOD HIGH**		
6.1			**White-winged Scoter**	MOD HIGH	HIGH	**HIGH**		
6.1			**Bufflehead**	MODERATE	MOD LOW	**MOD LOW**		
6.1			**Gadwall**	MODERATE	MOD LOW	**MOD LOW**		
6.1			**Green-winged Teal**	MODERATE	MOD HIGH	**MOD HIGH**		
6.1			**Northern Shoveler**	MODERATE	MOD LOW	**MOD LOW**		
6.1			**Ring-necked Duck**	MODERATE	MOD LOW	**MOD LOW**		
6.1			**Red-breasted Merganser**	MOD LOW	MOD HIGH	**MODERATE**		
7			**American Black Duck**	HIGH	MOD HIGH	**HIGH**		
7	1002	1002/1003	**Common Eider**	HIGH	HIGH	**HIGHEST**	MOD HIGH	**HIGH**
7			**Lesser Scaup**	HIGH	MOD LOW	**MODERATE**		
7			**Northern Pintail**	HIGH	MOD LOW	**MODERATE**		
7			**American Wigeon**	MOD HIGH	MOD LOW	**MOD LOW**		
7			**Black Scoter**	MOD HIGH	MOD HIGH	**MOD HIGH**		
7			**Common Goldeneye**	MOD HIGH	HIGH	**HIGH**	MOD LOW	**MOD LOW**
7			**King Eider**	MOD HIGH	MOD LOW	**MOD LOW**		
7			**Long-tailed Duck**	MOD HIGH	HIGH	**HIGH**		
7			**Surf Scoter**	MOD HIGH	HIGH	**HIGH**		
7		1003	**White-winged Scoter**	MOD HIGH			MOD HIGH	**MOD HIGH**
7			**Barrow's Goldeneye**	MODERATE	MOD HIGH	**MOD HIGH**		
7			**Bufflehead**	MODERATE	MOD LOW	**MOD LOW**		
7			**Green-winged Teal**	MODERATE	MOD LOW	**MOD LOW**		
7			**Harlequin Duck**	MODERATE	HIGH	**HIGH**		
7			**Ring-necked Duck**	MODERATE	MOD LOW	**MOD LOW**		
7			**Common Merganser**	MOD LOW	MOD HIGH	**MODERATE**	MOD LOW	**MOD LOW**
7			**Red-breasted Merganser**	MOD LOW	MOD HIGH	**MODERATE**		
7.1			**American Black Duck**	HIGH	MOD HIGH	**HIGH**	MOD HIGH	**HIGH**
7.1	1002	1002	**Common Eider**	HIGH	MOD LOW	**MODERATE**	HIGH	**HIGHEST**

7.1			**Lesser Scaup**	HIGH	MOD LOW	**MODERATE**		
7.1			**Mallard**	HIGH	MOD LOW	**MODERATE**		
7.1			**Northern Pintail**	HIGH	MOD LOW	**MODERATE**		
7.1			**American Wigeon**	MOD HIGH	MOD LOW	**MOD LOW**		
7.1		1002	**Black Scoter**	MOD HIGH			MOD HIGH	**MOD HIGH**
7.1			**Common Goldeneye**	MOD HIGH	MOD LOW	**MOD LOW**		
7.1			**King Eider**	MOD HIGH	MOD HIGH	**MOD HIGH**		
7.1			**Long-tailed Duck**	MOD HIGH	MOD HIGH	**MOD HIGH**		
7.1			**Surf Scoter**	MOD HIGH	HIGH	**HIGH**		
7.1			**White-winged Scoter**	MOD HIGH	MOD LOW	**MOD LOW**		
7.1			**Bufflehead**	MODERATE	MOD LOW	**MOD LOW**		
7.1			**Green-winged Teal**	MODERATE	MOD LOW	**MOD LOW**		
7.1			**Ring-necked Duck**	MODERATE	MOD LOW	**MOD LOW**		
7.2			**Lesser Scaup**	HIGH	MOD HIGH	**HIGH**		
7.2			**Mallard**	HIGH	MOD LOW	**MODERATE**		
7.2			**Northern Pintail**	HIGH	MOD LOW	**MODERATE**		
7.2			**American Wigeon**	MOD HIGH	MOD LOW	**MOD LOW**		
7.2			**Black Scoter**	MOD HIGH	HIGH	**HIGH**		
7.2			**Blue-winged Teal**	MOD HIGH	MOD LOW	**MOD LOW**		
7.2			**Canvasback**	MOD HIGH	MOD LOW	**MOD LOW**		
7.2			**Common Goldeneye**	MOD HIGH	MOD LOW	**MOD LOW**		
7.2			**Long-tailed Duck**	MOD HIGH	MOD LOW	**MOD LOW**		
7.2			**Redhead**	MOD HIGH	MOD LOW	**MOD LOW**		
7.2			**White-winged Scoter**	MOD HIGH	MOD HIGH	**MOD HIGH**		
7.2			**Bufflehead**	MODERATE	MOD HIGH	**MOD HIGH**		
7.2			**Gadwall**	MODERATE	MOD LOW	**MOD LOW**		
7.2			**Green-winged Teal**	MODERATE	MOD LOW	**MOD LOW**		
7.2			**Northern Shoveler**	MODERATE	MOD LOW	**MOD LOW**		
7.2			**Ring-necked Duck**	MODERATE	MOD LOW	**MOD LOW**		
8			**American Black Duck**	HIGH	MOD HIGH	**HIGH**	MOD HIGH	**HIGH**
8	1003	1003	**Common Eider**	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
8			**Lesser Scaup**	HIGH	MOD LOW	**MODERATE**		
8			**Mallard**	HIGH	MOD LOW	**MODERATE**	MOD LOW	**MODERATE**
8			**American Wigeon**	MOD HIGH	MOD LOW	**MOD LOW**		
8		1003	**Black Scoter**	MOD HIGH			MOD HIGH	**MOD HIGH**
8			**Blue-winged Teal**	MOD HIGH	MOD LOW	**MOD LOW**		
8			**Common Goldeneye**	MOD HIGH	HIGH	**HIGH**	HIGH	**HIGH**

8		1003	**King Eider**	MOD HIGH			MOD HIGH	**MOD HIGH**
	Pelagic WCRs			**Continental**	**Breeding**	**Breeding**	**Nonbreeding**	**Nonbreeding**
WCR	**Breeding**	**NonBreeding**	**Species/Population**	**Priority**	**Importance**	**Need**	**Importance**	**Need**
8		1003	**Long-tailed Duck**	MOD HIGH			MOD HIGH	**MOD HIGH**
8		1003	**Surf Scoter**	MOD HIGH	MOD HIGH	**MOD HIGH**	HIGH	**HIGH**
8			**Barrow's Goldeneye**	MODERATE	HIGH	**HIGH**	MOD HIGH	**MOD HIGH**
8			**Bufflehead**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
8			**Green-winged Teal**	MODERATE	MOD LOW	**MOD LOW**		
8		1003	**Harlequin Duck**	MODERATE	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
8			**Ring-necked Duck**	MODERATE	MOD HIGH	**MOD HIGH**		
8			**Common Merganser**	MOD LOW			HIGH	**HIGH**
8			**Hooded Merganser**	MOD LOW	MOD HIGH	**MODERATE**		
8			**Red-breasted Merganser**	MOD LOW	MOD HIGH	**MODERATE**	MOD LOW	**MOD LOW**
8.1			**Lesser Scaup**	HIGH	MOD HIGH	**HIGH**		
8.1			**Mallard**	HIGH	MOD HIGH	**HIGH**		
8.1			**Northern Pintail**	HIGH	MOD LOW	**MODERATE**		
8.1			**American Wigeon**	MOD HIGH	MOD HIGH	**MOD HIGH**		
8.1			**Black Scoter**	MOD HIGH	MOD HIGH	**MOD HIGH**		
8.1			**Blue-winged Teal**	MOD HIGH	MOD LOW	**MOD LOW**		
8.1			**Common Goldeneye**	MOD HIGH	HIGH	**HIGH**		
8.1			**Redhead**	MOD HIGH	MOD LOW	**MOD LOW**		
8.1			**Surf Scoter**	MOD HIGH	MOD HIGH	**MOD HIGH**		
8.1			**White-winged Scoter**	MOD HIGH	MOD HIGH	**MOD HIGH**		
8.1			**Bufflehead**	MODERATE	MOD HIGH	**MOD HIGH**		
8.1			**Gadwall**	MODERATE	MOD LOW	**MOD LOW**		
8.1			**Green-winged Teal**	MODERATE	MOD HIGH	**MOD HIGH**		
8.1			**Northern Shoveler**	MODERATE	MOD LOW	**MOD LOW**		
8.1			**Ring-necked Duck**	MODERATE	HIGH	**HIGH**		
8.1			**Red-breasted Merganser**	MOD LOW	MOD HIGH	**MODERATE**		
8.2			**American Black Duck**	HIGH	MOD HIGH	**HIGH**		
8.2	1003	1003	**Common Eider**	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
8.2			**Common Goldeneye**	MOD HIGH	MOD LOW	**MOD LOW**		
8.2		1003	**King Eider**	MOD HIGH			MOD HIGH	**MOD HIGH**
8.2		1003	**Long-tailed Duck**	MOD HIGH			MOD HIGH	**MOD HIGH**
8.2		1003	**White-winged Scoter**	MOD HIGH	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
8.2			**Green-winged Teal**	MODERATE	MOD LOW	**MOD LOW**		
8.2		1003	**Harlequin Duck**	MODERATE	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**

WCR	Pelagic WCRs Breeding	Pelagic WCRs NonBreeding	Species/Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
8.2			**Ring-necked Duck**	MODERATE	MOD HIGH	**MOD HIGH**		
8.2			**Red-breasted Merganser**	MOD LOW	MOD HIGH	**MODERATE**		
9			**Lesser Scaup**	HIGH	MOD LOW	**MODERATE**	MOD LOW	**MODERATE**
9			**Mallard**	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
9			**Northern Pintail**	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
9			**American Wigeon**	MOD HIGH	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
9			**Canvasback**	MOD HIGH	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
9			**Cinnamon Teal**	MOD HIGH	MOD HIGH	**MOD HIGH**		
9			**Common Goldeneye**	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
9			**Redhead**	MOD HIGH	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
9			**Barrow's Goldeneye**	MODERATE	HIGH	**HIGH**	MOD HIGH	**MOD HIGH**
9			**Bufflehead**	MODERATE	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
9			**Gadwall**	MODERATE	MOD HIGH	**MOD HIGH**		
9			**Greater Scaup**	MODERATE	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
9			**Green-winged Teal**	MODERATE	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
9			**Harlequin Duck**	MODERATE			HIGH	**HIGH**
9			**Northern Shoveler**	MODERATE	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
9			**Ring-necked Duck**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
9			**Wood Duck**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
9			**Ruddy Duck**	MOD LOW	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**
10			**Lesser Scaup**	HIGH	MOD HIGH	**MOD HIGH**	MOD LOW	**MODERATE**
10			**Mallard**	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
10			**Northern Pintail**	HIGH	MOD LOW	**MODERATE**		
10			**American Wigeon**	MOD HIGH	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
10			**Canvasback**	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
10			**Cinnamon Teal**	MOD HIGH	MOD HIGH	**MOD HIGH**		
10			**Common Goldeneye**	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
10			**Redhead**	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
10			**White-winged Scoter**	MOD HIGH	MOD HIGH	**MOD HIGH**		
10			**Barrow's Goldeneye**	MODERATE	HIGH	**HIGH**	MOD HIGH	**MOD HIGH**
10			**Bufflehead**	MODERATE	HIGH	**HIGH**	MOD LOW	**MOD LOW**
10			**Gadwall**	MODERATE	MOD LOW	**MOD LOW**		
10			**Greater Scaup**	MODERATE			MOD LOW	**MOD LOW**
10			**Green-winged Teal**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
10			**Harlequin Duck**	MODERATE	MOD HIGH	**MOD HIGH**		

10			**Northern Shoveler**	MODERATE	MOD LOW	**MOD LOW**		
	Pelagic WCRs			**Continental**	**Breeding**	**Breeding**	**Nonbreeding**	**Nonbreeding**
WCR	**Breeding**	**NonBreeding**	**Species/Population**	**Priority**	**Importance**	**Need**	**Importance**	**Need**
10			**Ring-necked Duck**	MODERATE	MOD HIGH	**MOD HIGH**		
10			**Wood Duck**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
10			**Hooded Merganser**	MOD LOW	MOD HIGH	**MODERATE**		
11			**Lesser Scaup**	HIGH	MOD HIGH	**HIGH**	HIGH	**HIGHEST**
11			**Mallard**	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
11			**Northern Pintail**	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
11			**American Wigeon**	MOD HIGH	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
11			**Blue-winged Teal**	MOD HIGH	HIGH	**HIGH**	MOD HIGH	**MOD HIGH**
11			**Canvasback**	MOD HIGH	HIGH	**HIGH**	HIGH	**HIGH**
11			**Common Goldeneye**	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
11			**Redhead**	MOD HIGH	HIGH	**HIGH**	HIGH	**HIGH**
11			**White-winged Scoter**	MOD HIGH	MOD LOW	**MOD LOW**		
11			**Bufflehead**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
11			**Gadwall**	MODERATE	HIGH	**HIGH**	MOD LOW	**MOD LOW**
11			**Green-winged Teal**	MODERATE	HIGH	**HIGH**	MOD LOW	**MOD LOW**
11			**Northern Shoveler**	MODERATE	HIGH	**HIGH**	HIGH	**HIGH**
11			**Ring-necked Duck**	MODERATE	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
11			**Wood Duck**	MODERATE	MOD LOW	**MOD LOW**		
11			**Ruddy Duck**	MOD LOW	HIGH	**HIGH**		
12			**American Black Duck**	HIGH	MOD HIGH	**HIGH**	MOD LOW	**MODERATE**
12			**Lesser Scaup**	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
12			**Mallard**	HIGH	MOD LOW	**MODERATE**	MOD LOW	**MODERATE**
12			**American Wigeon**	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
12			**Black Scoter**	MOD HIGH			HIGH	**HIGH**
12			**Blue-winged Teal**	MOD HIGH	MOD LOW	**MOD LOW**		
12			**Canvasback**	MOD HIGH			MOD LOW	**MOD LOW**
12			**Common Goldeneye**	MOD HIGH	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
12			**Long-tailed Duck**	MOD HIGH			MOD LOW	**MOD LOW**
12			**Redhead**	MOD HIGH			MOD LOW	**MOD LOW**
12			**Surf Scoter**	MOD HIGH			HIGH	**HIGH**
12			**White-winged Scoter**	MOD HIGH			MOD HIGH	**MOD HIGH**
12			**Bufflehead**	MODERATE	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
12			**Greater Scaup**	MODERATE			MOD HIGH	**MOD HIGH**
12			**Green-winged Teal**	MODERATE	MOD LOW	**MOD LOW**		

12			**Ring-necked Duck**	MODERATE	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**

WCR	Pelagic WCRs Breeding	Pelagic WCRs NonBreeding	Species/Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
12			**Wood Duck**	MODERATE	MOD LOW	**MOD LOW**		
12			**Hooded Merganser**	MOD LOW	HIGH	**HIGH**		
13			**American Black Duck**	HIGH	MOD HIGH	**HIGH**	MOD HIGH	**HIGH**
13			**Common Eider**	HIGH			MOD LOW	**MODERATE**
13			**Lesser Scaup**	HIGH			HIGH	**HIGHEST**
13			**Mallard**	HIGH	MOD HIGH	**HIGH**	MOD LOW	**MODERATE**
13			**Northern Pintail**	HIGH			MOD LOW	**MODERATE**
13			**American Wigeon**	MOD HIGH	MOD LOW	**MOD LOW**		
13			**Black Scoter**	MOD HIGH			MOD HIGH	**MOD HIGH**
13			**Blue-winged Teal**	MOD HIGH	MOD LOW	**MOD LOW**		
13			**Canvasback**	MOD HIGH	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
13			**Common Goldeneye**	MOD HIGH	MOD LOW	**MOD LOW**	HIGH	**HIGH**
13			**Long-tailed Duck**	MOD HIGH			HIGH	**HIGH**
13			**Redhead**	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
13			**Surf Scoter**	MOD HIGH			HIGH	**HIGH**
13			**White-winged Scoter**	MOD HIGH			MOD HIGH	**MOD HIGH**
13			**Bufflehead**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
13			**Gadwall**	MODERATE			MOD LOW	**MOD LOW**
13			**Greater Scaup**	MODERATE			MOD HIGH	**MOD HIGH**
13			**Green-winged Teal**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
13			**Ring-necked Duck**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
13			**Wood Duck**	MODERATE	MOD LOW	**MOD LOW**		
13			**Common Merganser**	MOD LOW			MOD HIGH	**MODERATE**
13			**Hooded Merganser**	MOD LOW	MOD HIGH	**MODERATE**		
13			**Red-breasted Merganser**	MOD LOW			HIGH	**MODERATE**
14			**American Black Duck**	HIGH	HIGH	**HIGHEST**	MOD HIGH	**HIGH**
14	1004	1004	**Common Eider**	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
14			**Lesser Scaup**	HIGH			MOD LOW	**MODERATE**
14			**Mallard**	HIGH	MOD LOW	**MODERATE**	MOD LOW	**MODERATE**
14			**Northern Pintail**	HIGH	MOD LOW	**MODERATE**	MOD LOW	**MODERATE**
14			**American Wigeon**	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
14		1004	**Black Scoter**	MOD HIGH			MOD LOW	**MOD LOW**
14			**Blue-winged Teal**	MOD HIGH	MOD LOW	**MOD LOW**		
14			**Common Goldeneye**	MOD HIGH	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**

14		1004	**Long-tailed Duck**	MOD HIGH			HIGH	**HIGH**
	Pelagic WCRs			**Continental**	**Breeding**	**Breeding**	**Nonbreeding**	**Nonbreeding**
WCR	**Breeding**	**NonBreeding**	**Species/Population**	**Priority**	**Importance**	**Need**	**Importance**	**Need**
14		1004	**Surf Scoter**	MOD HIGH			HIGH	**HIGH**
14		1004	**White-winged Scoter**	MOD HIGH			MOD HIGH	**MOD HIGH**
14			**Barrow's Goldeneye**	MODERATE			MOD HIGH	**MOD HIGH**
14			**Bufflehead**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
14			**Gadwall**	MODERATE	MOD LOW	**MOD LOW**		
14			**Green-winged Teal**	MODERATE	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
14		1004	**Harlequin Duck**	MODERATE			MOD HIGH	**MOD HIGH**
14			**Ring-necked Duck**	MODERATE	MOD HIGH	**MOD HIGH**		
14			**Wood Duck**	MODERATE	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
14			**Common Merganser**	MOD LOW			MOD HIGH	**MODERATE**
14			**Hooded Merganser**	MOD LOW	MOD HIGH	**MODERATE**		
14			**Red-breasted Merganser**	MOD LOW			MOD HIGH	**MODERATE**
15			**Mallard**	HIGH	MOD LOW	**MODERATE**	MOD LOW	**MODERATE**
15			**Northern Pintail**	HIGH			MOD LOW	**MODERATE**
15			**American Wigeon**	MOD HIGH			MOD LOW	**MOD LOW**
15			**Canvasback**	MOD HIGH			MOD LOW	**MOD LOW**
15			**Cinnamon Teal**	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
15			**Bufflehead**	MODERATE			MOD LOW	**MOD LOW**
15			**Northern Shoveler**	MODERATE			MOD LOW	**MOD LOW**
15			**Wood Duck**	MODERATE	MOD LOW	**MOD LOW**		
16			**Lesser Scaup**	HIGH	MOD LOW	**MODERATE**		
16			**Mallard**	HIGH	MOD LOW	**MODERATE**	MOD LOW	**MODERATE**
16			**Northern Pintail**	HIGH	MOD LOW	**MODERATE**		
16			**American Wigeon**	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
16			**Blue-winged/CinnamonTeal**	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
16			**Canvasback**	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
16			**Common Goldeneye**	MOD HIGH			MOD LOW	**MOD LOW**
16			**Redhead**	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
16			**Bufflehead**	MODERATE			MOD LOW	**MOD LOW**
16			**Gadwall**	MODERATE	MOD LOW	**MOD LOW**		
16			**Green-winged Teal**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
16			**Northern Shoveler**	MODERATE			MOD LOW	**MOD LOW**
16			**Ring-necked Duck**	MODERATE	MOD LOW	**MOD LOW**		
16			**Common Merganser**	MOD LOW	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**

17			**Lesser Scaup**	HIGH	MOD LOW	**MODERATE**		

WCR	Pelagic WCRs Breeding	Pelagic WCRs NonBreeding	Species/Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
17			**Mallard**	HIGH	MOD HIGH	**HIGH**	MOD LOW	**MODERATE**
17			**Northern Pintail**	HIGH	MOD HIGH	**HIGH**	MOD LOW	**MODERATE**
17			**American Wigeon**	MOD HIGH	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
17			**Blue-winged Teal**	MOD HIGH	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
17			**Canvasback**	MOD HIGH	MOD LOW	**MOD LOW**		
17			**Common Goldeneye**	MOD HIGH			MOD LOW	**MOD LOW**
17			**Redhead**	MOD HIGH	MOD LOW	**MOD LOW**		
17			**Bufflehead**	MODERATE	MOD LOW	**MOD LOW**		
17			**Gadwall**	MODERATE	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
17			**Green-winged Teal**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
17			**Northern Shoveler**	MODERATE	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
17			**Ring-necked Duck**	MODERATE	MOD LOW	**MOD LOW**		
18			**Mallard**	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
18			**Northern Pintail**	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
18			**American Wigeon**	MOD HIGH			MOD LOW	**MOD LOW**
18			**Blue-winged Teal**	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
18			**Common Goldeneye**	MOD HIGH			MOD HIGH	**MOD HIGH**
18			**Redhead**	MOD HIGH			MOD LOW	**MOD LOW**
18			**Gadwall**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
18			**Green-winged Teal**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
18			**Northern Shoveler**	MODERATE			MOD LOW	**MOD LOW**
18			**Common Merganser**	MOD LOW			MOD HIGH	**MODERATE**
18			**Hooded Merganser**	MOD LOW			MOD HIGH	**MODERATE**
19			**Mallard**	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
19			**Northern Pintail**	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
19			**American Wigeon**	MOD HIGH			MOD LOW	**MOD LOW**
19			**Blue-winged/CinnamonTeal**	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
19			**Canvasback**	MOD HIGH			MOD LOW	**MOD LOW**
19			**Common Goldeneye**	MOD HIGH			MOD HIGH	**MOD HIGH**
19			**Redhead**	MOD HIGH			MOD LOW	**MOD LOW**
19			**Gadwall**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
19			**Green-winged Teal**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
19			**Northern Shoveler**	MODERATE			MOD LOW	**MOD LOW**
19			**Ring-necked Duck**	MODERATE			MOD LOW	**MOD LOW**

19			**Wood Duck**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
	Pelagic WCRs			**Continental**	**Breeding**	**Breeding**	**Nonbreeding**	**Nonbreeding**
WCR	**Breeding**	**NonBreeding**	**Species/Population**	**Priority**	**Importance**	**Need**	**Importance**	**Need**
19			**Common Merganser**	MOD LOW			MOD HIGH	**MODERATE**
20			**Northern Pintail**	HIGH			MOD LOW	**MODERATE**
20			**American Wigeon**	MOD HIGH			MOD LOW	**MOD LOW**
20			**Canvasback**	MOD HIGH			MOD LOW	**MOD LOW**
20			**Redhead**	MOD HIGH			MOD LOW	**MOD LOW**
20			**Bufflehead**	MODERATE			MOD LOW	**MOD LOW**
20			**Gadwall**	MODERATE			MOD LOW	**MOD LOW**
20			**Green-winged Teal**	MODERATE			MOD LOW	**MOD LOW**
20			**Wood Duck**	MODERATE			MOD LOW	**MOD LOW**
21			**Lesser Scaup**	HIGH			MOD LOW	**MODERATE**
21			**Mallard**	HIGH			MOD LOW	**MODERATE**
21			**Northern Pintail**	HIGH			MOD LOW	**MODERATE**
21			**American Wigeon**	MOD HIGH			MOD HIGH	**MOD HIGH**
21			**Blue-winged Teal**	MOD HIGH			MOD HIGH	**MOD HIGH**
21			**Canvasback**	MOD HIGH			MOD HIGH	**MOD HIGH**
21			**Common Goldeneye**	MOD HIGH			MOD HIGH	**MOD HIGH**
21			**Redhead**	MOD HIGH			MOD HIGH	**MOD HIGH**
21			**Bufflehead**	MODERATE			MOD LOW	**MOD LOW**
21			**Gadwall**	MODERATE			MOD HIGH	**MOD HIGH**
21			**Green-winged Teal**	MODERATE			MOD HIGH	**MOD HIGH**
21			**Mottled Duck**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
21			**Northern Shoveler**	MODERATE			MOD HIGH	**MOD HIGH**
21			**Ring-necked Duck**	MODERATE			MOD HIGH	**MOD HIGH**
21			**Wood Duck**	MODERATE	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
22			**American Black Duck**	HIGH			MOD HIGH	**HIGH**
22			**Lesser Scaup**	HIGH			MOD LOW	**MODERATE**
22			**Mallard**	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
22			**American Wigeon**	MOD HIGH			MOD LOW	**MOD LOW**
22			**Blue-winged Teal**	MOD HIGH	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
22			**Canvasback**	MOD HIGH			MOD HIGH	**MOD HIGH**
22			**Common Goldeneye**	MOD HIGH			MOD HIGH	**MOD HIGH**
22			**Redhead**	MOD HIGH			MOD LOW	**MOD LOW**
22			**Bufflehead**	MODERATE			MOD LOW	**MOD LOW**
22			**Gadwall**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**

WCR	Pelagic WCRs Breeding	Pelagic WCRs NonBreeding	Species/Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
22			**Greater Scaup**	MODERATE			MOD LOW	**MOD LOW**
22			**Green-winged Teal**	MODERATE			MOD LOW	**MOD LOW**
22			**Northern Shoveler**	MODERATE			MOD LOW	**MOD LOW**
22			**Ring-necked Duck**	MODERATE			MOD HIGH	**MOD HIGH**
22			**Wood Duck**	MODERATE	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
22			**Common Merganser**	MOD LOW			MOD HIGH	**MODERATE**
22			**Hooded Merganser**	MOD LOW			MOD HIGH	**MODERATE**
23			**American Black Duck**	HIGH	MOD HIGH	**HIGH**	MOD HIGH	**HIGH**
23			**Lesser Scaup**	HIGH			MOD HIGH	**HIGH**
23			**Mallard**	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
23			**American Wigeon**	MOD HIGH			MOD LOW	**MOD LOW**
23			**Blue-winged Teal**	MOD HIGH	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
23			**Canvasback**	MOD HIGH			MOD HIGH	**MOD HIGH**
23			**Common Goldeneye**	MOD HIGH			MOD HIGH	**MOD HIGH**
23		1016	**Long-tailed Duck**	MOD HIGH			MOD LOW	**MOD LOW**
23			**Redhead**	MOD HIGH			MOD HIGH	**MOD HIGH**
23			**Bufflehead**	MODERATE			MOD LOW	**MOD LOW**
23			**Gadwall**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
23			**Greater Scaup**	MODERATE			MOD HIGH	**MOD HIGH**
23			**Green-winged Teal**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
23			**Northern Shoveler**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
23			**Ring-necked Duck**	MODERATE	MOD HIGH	**MOD HIGH**		
23			**Wood Duck**	MODERATE	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
23			**Hooded Merganser**	MOD LOW			MOD HIGH	**MODERATE**
24			**American Black Duck**	HIGH			MOD HIGH	**HIGH**
24			**Lesser Scaup**	HIGH			MOD LOW	**MODERATE**
24			**Mallard**	HIGH			MOD HIGH	**HIGH**
24			**Northern Pintail**	HIGH			MOD LOW	**MODERATE**
24			**American Wigeon**	MOD HIGH			MOD LOW	**MOD LOW**
24			**Blue-winged Teal**	MOD HIGH			MOD LOW	**MOD LOW**
24			**Canvasback**	MOD HIGH			MOD LOW	**MOD LOW**
24			**Common Goldeneye**	MOD HIGH			MOD HIGH	**MOD HIGH**
24			**Bufflehead**	MODERATE			MOD LOW	**MOD LOW**
24			**Gadwall**	MODERATE			MOD LOW	**MOD LOW**
24			**Greater Scaup**	MODERATE			MOD LOW	**MOD LOW**

WCR	Pelagic WCRs Breeding	Pelagic WCRs NonBreeding	Species/Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
24			**Northern Shoveler**	MODERATE			MOD LOW	**MOD LOW**
24			**Ring-necked Duck**	MODERATE			MOD LOW	**MOD LOW**
24			**Wood Duck**	MODERATE	MOD HIGH	**MOD HIGH**	MOD LOW	**MOD LOW**
24			**Hooded Merganser**	MOD LOW			MOD HIGH	**MODERATE**
25			**Lesser Scaup**	HIGH			MOD HIGH	**HIGH**
25			**Mallard**	HIGH			MOD HIGH	**HIGH**
25			**Northern Pintail**	HIGH			MOD LOW	**MODERATE**
25			**American Wigeon**	MOD HIGH			MOD HIGH	**MOD HIGH**
25			**Blue-winged Teal**	MOD HIGH			MOD HIGH	**MOD HIGH**
25			**Canvasback**	MOD HIGH			MOD HIGH	**MOD HIGH**
25			**Common Goldeneye**	MOD HIGH			MOD LOW	**MOD LOW**
25			**Redhead**	MOD HIGH			MOD LOW	**MOD LOW**
25			**Bufflehead**	MODERATE			MOD LOW	**MOD LOW**
25			**Gadwall**	MODERATE			MOD HIGH	**MOD HIGH**
25			**Green-winged Teal**	MODERATE			MOD HIGH	**MOD HIGH**
25			**Mottled Duck**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
25			**Northern Shoveler**	MODERATE			MOD LOW	**MOD LOW**
25			**Ring-necked Duck**	MODERATE			MOD HIGH	**MOD HIGH**
25			**Wood Duck**	MODERATE	MOD HIGH	**MOD HIGH**	HIGH	**HIGH**
26			**Lesser Scaup**	HIGH			MOD HIGH	**HIGH**
26			**Mallard**	HIGH			HIGH	**HIGHEST**
26			**Northern Pintail**	HIGH			MOD HIGH	**HIGH**
26			**American Wigeon**	MOD HIGH			MOD HIGH	**MOD HIGH**
26			**Blue-winged Teal**	MOD HIGH			MOD HIGH	**MOD HIGH**
26			**Canvasback**	MOD HIGH			MOD HIGH	**MOD HIGH**
26			**Common Goldeneye**	MOD HIGH			MOD LOW	**MOD LOW**
26			**Redhead**	MOD HIGH			MOD LOW	**MOD LOW**
26			**Bufflehead**	MODERATE			MOD LOW	**MOD LOW**
26			**Gadwall**	MODERATE			MOD HIGH	**MOD HIGH**
26			**Greater Scaup**	MODERATE			MOD HIGH	**MOD HIGH**
26			**Green-winged Teal**	MODERATE			MOD HIGH	**MOD HIGH**
26			**Mottled Duck**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
26			**Northern Shoveler**	MODERATE			MOD HIGH	**MOD HIGH**
26			**Ring-necked Duck**	MODERATE			MOD HIGH	**MOD HIGH**
26			**Wood Duck**	MODERATE	HIGH	**HIGH**	MOD HIGH	**MOD HIGH**

26			**Ruddy Duck**	MOD LOW			MOD HIGH	**MODERATE**
	Pelagic WCRs			**Continental**	**Breeding**	**Breeding**	**Nonbreeding**	**Nonbreeding**
WCR	**Breeding**	**NonBreeding**	**Species/Population**	**Priority**	**Importance**	**Need**	**Importance**	**Need**
27			**American Black Duck**	HIGH			MOD HIGH	**HIGH**
27			**Lesser Scaup**	HIGH			MOD HIGH	**HIGH**
27			**Mallard**	HIGH			MOD HIGH	**HIGH**
27			**American Wigeon**	MOD HIGH			MOD LOW	**MOD LOW**
27			**Canvasback**	MOD HIGH			MOD LOW	**MOD LOW**
27			**Common Goldeneye**	MOD HIGH			MOD HIGH	**MOD HIGH**
27			**Redhead**	MOD HIGH			MOD LOW	**MOD LOW**
27			**Bufflehead**	MODERATE			MOD HIGH	**MOD HIGH**
27			**Gadwall**	MODERATE			MOD LOW	**MOD LOW**
27			**Greater Scaup**	MODERATE			MOD HIGH	**MOD HIGH**
27			**Ring-necked Duck**	MODERATE			MOD HIGH	**MOD HIGH**
27			**Wood Duck**	MODERATE	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
27			**Ruddy Duck**	MOD LOW			MOD HIGH	**MODERATE**
27.1			**American Black Duck**	HIGH	MOD LOW	**MODERATE**	HIGH	**HIGHEST**
27.1			**Lesser Scaup**	HIGH			HIGH	**HIGHEST**
27.1			**Mallard**	HIGH			MOD HIGH	**HIGH**
27.1			**Northern Pintail**	HIGH			MOD HIGH	**HIGH**
27.1			**American Wigeon**	MOD HIGH			MOD HIGH	**MOD HIGH**
27.1		1006	**Black Scoter**	MOD HIGH			MOD HIGH	**MOD HIGH**
27.1			**Blue-winged Teal**	MOD HIGH			MOD HIGH	**MOD HIGH**
27.1			**Canvasback**	MOD HIGH			HIGH	**HIGH**
27.1			**Common Goldeneye**	MOD HIGH			MOD HIGH	**MOD HIGH**
27.1		1006	**Long-tailed Duck**	MOD HIGH			MOD LOW	**MOD LOW**
27.1			**Redhead**	MOD HIGH			MOD HIGH	**MOD HIGH**
27.1		1006	**Surf Scoter**	MOD HIGH			HIGH	**HIGH**
27.1		1006	**White-winged Scoter**	MOD HIGH			MOD HIGH	**MOD HIGH**
27.1			**Bufflehead**	MODERATE			HIGH	**HIGH**
27.1			**Gadwall**	MODERATE			MOD HIGH	**MOD HIGH**
27.1			**Greater Scaup**	MODERATE			HIGH	**HIGH**
27.1			**Green-winged Teal**	MODERATE			MOD HIGH	**MOD HIGH**
27.1			**Mottled Duck**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
27.1			**Northern Shoveler**	MODERATE			MOD HIGH	**MOD HIGH**
27.1			**Ring-necked Duck**	MODERATE			MOD HIGH	**MOD HIGH**
27.1			**Wood Duck**	MODERATE	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**

WCR	Pelagic WCRs Breeding	Pelagic WCRs NonBreeding	Species/Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
27.1			**Hooded Merganser**	MOD LOW			MOD HIGH	**MODERATE**
27.1			**Red-breasted Merganser**	MOD LOW			MOD HIGH	**MODERATE**
27.1			**Ruddy Duck**	MOD LOW			HIGH	**HIGH**
27.2			**Lesser Scaup**	HIGH			HIGH	**HIGHEST**
27.2			**Mallard**	HIGH			MOD LOW	**MODERATE**
27.2			**Northern Pintail**	HIGH			MOD LOW	**MODERATE**
27.2			**American Wigeon**	MOD HIGH			MOD HIGH	**MOD HIGH**
27.2			**Blue-winged Teal**	MOD HIGH			MOD HIGH	**MOD HIGH**
27.2			**Canvasback**	MOD HIGH			MOD HIGH	**MOD HIGH**
27.2			**Common Goldeneye**	MOD HIGH			MOD LOW	**MOD LOW**
27.2			**Redhead**	MOD HIGH			HIGH	**HIGH**
27.2			**Bufflehead**	MODERATE			MOD HIGH	**MOD HIGH**
27.2			**Gadwall**	MODERATE			MOD HIGH	**MOD HIGH**
27.2			**Greater Scaup**	MODERATE			MOD HIGH	**MOD HIGH**
27.2			**Green-winged Teal**	MODERATE			MOD HIGH	**MOD HIGH**
27.2			**Mottled Duck**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
27.2			**Northern Shoveler**	MODERATE			MOD HIGH	**MOD HIGH**
27.2			**Ring-necked Duck**	MODERATE			MOD HIGH	**MOD HIGH**
27.2			**Wood Duck**	MODERATE	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
27.2			**Hooded Merganser**	MOD LOW			MOD HIGH	**MODERATE**
27.2			**Red-breasted Merganser**	MOD LOW			MOD HIGH	**MODERATE**
27.2			**Ruddy Duck**	MOD LOW			MOD HIGH	**MODERATE**
28			**American Black Duck**	HIGH			MOD HIGH	**HIGH**
28			**Mallard**	HIGH			MOD LOW	**MODERATE**
28			**Canvasback**	MOD HIGH			MOD LOW	**MOD LOW**
28			**Common Goldeneye**	MOD HIGH			MOD LOW	**MOD LOW**
28			**Bufflehead**	MODERATE			MOD LOW	**MOD LOW**
28			**Gadwall**	MODERATE			MOD LOW	**MOD LOW**
28			**Wood Duck**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
29			**American Black Duck**	HIGH			MOD HIGH	**HIGH**
29			**Lesser Scaup**	HIGH			MOD LOW	**MODERATE**
29			**Mallard**	HIGH			MOD LOW	**MODERATE**
29			**Canvasback**	MOD HIGH			MOD LOW	**MOD LOW**
29			**Common Goldeneye**	MOD HIGH			MOD LOW	**MOD LOW**
29			**Redhead**	MOD HIGH			MOD LOW	**MOD LOW**

WCR	Pelagic WCRs Breeding	Pelagic WCRs NonBreeding	Species/Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
29			**Bufflehead**	MODERATE			MOD LOW	**MOD LOW**
29			**Greater Scaup**	MODERATE			MOD LOW	**MOD LOW**
29			**Ring-necked Duck**	MODERATE			MOD LOW	**MOD LOW**
29			**Wood Duck**	MODERATE	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
29			**Hooded Merganser**	MOD LOW			MOD HIGH	**MODERATE**
30			**American Black Duck**	HIGH	MOD HIGH	**HIGH**	HIGH	**HIGHEST**
30		1005	**Common Eider**	HIGH			HIGH	**HIGHEST**
30			**Lesser Scaup**	HIGH			MOD HIGH	**HIGH**
30			**Mallard**	HIGH	MOD LOW	**MODERATE**	MOD HIGH	**HIGH**
30			**Northern Pintail**	HIGH			MOD LOW	**MODERATE**
30			**American Wigeon**	MOD HIGH			MOD LOW	**MOD LOW**
30		1005	**Black Scoter**	MOD HIGH			HIGH	**HIGH**
30			**Blue-winged Teal**	MOD HIGH			MOD LOW	**MOD LOW**
30			**Canvasback**	MOD HIGH			HIGH	**HIGH**
30			**Common Goldeneye**	MOD HIGH			MOD HIGH	**MOD HIGH**
30		1005	**King Eider**	MOD HIGH			MOD HIGH	**MOD HIGH**
30		1005	**Long-tailed Duck**	MOD HIGH			HIGH	**HIGH**
30		1005	**Surf Scoter**	MOD HIGH			HIGH	**HIGH**
30		1005	**White-winged Scoter**	MOD HIGH			HIGH	**HIGH**
30			**Bufflehead**	MODERATE			HIGH	**HIGH**
30			**Gadwall**	MODERATE			MOD LOW	**MOD LOW**
30			**Greater Scaup**	MODERATE			HIGH	**HIGH**
30			**Green-winged Teal**	MODERATE			MOD LOW	**MOD LOW**
30		1005	**Harlequin Duck**	MODERATE			HIGH	**HIGH**
30			**Wood Duck**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
30			**Hooded Merganser**	MOD LOW			MOD HIGH	**MODERATE**
30			**Red-breasted Merganser**	MOD LOW			MOD HIGH	**MODERATE**
30			**Ruddy Duck**	MOD LOW			MOD HIGH	**MODERATE**
31			**Lesser Scaup**	HIGH			MOD HIGH	**HIGH**
31			**Northern Pintail**	HIGH			MOD LOW	**MODERATE**
31			**American Wigeon**	MOD HIGH			MOD HIGH	**MOD HIGH**
31			**Blue-winged Teal**	MOD HIGH			MOD HIGH	**MOD HIGH**
31			**Canvasback**	MOD HIGH			MOD LOW	**MOD LOW**
31			**Redhead**	MOD HIGH			MOD LOW	**MOD LOW**
31			**Bufflehead**	MODERATE			MOD LOW	**MOD LOW**

31			**Green-winged Teal**	MODERATE			MOD LOW	**MOD LOW**
	Pelagic WCRs			**Continental**	**Breeding**	**Breeding**	**Nonbreeding**	**Nonbreeding**
WCR	**Breeding**	**NonBreeding**	**Species/Population**	**Priority**	**Importance**	**Need**	**Importance**	**Need**
31			**Mottled Duck**	MODERATE	HIGH	**HIGH**	HIGH	**HIGH**
31			**Northern Shoveler**	MODERATE			MOD LOW	**MOD LOW**
31			**Ring-necked Duck**	MODERATE			HIGH	**HIGH**
31			**Wood Duck**	MODERATE	MOD LOW	**MOD LOW**		
31			**Hooded Merganser**	MOD LOW			MOD HIGH	**MODERATE**
32			**Lesser Scaup**	HIGH			MOD HIGH	**HIGH**
32			**Mallard**	HIGH	MOD LOW	**MODERATE**	MOD LOW	**MODERATE**
32			**Northern Pintail**	HIGH			MOD HIGH	**HIGH**
32			**American Wigeon**	MOD HIGH			MOD HIGH	**MOD HIGH**
32		1010	**Black Scoter**	MOD HIGH			MOD HIGH	**MOD HIGH**
32			**Canvasback**	MOD HIGH			MOD LOW	**MOD LOW**
32			**Common Goldeneye**	MOD HIGH			MOD LOW	**MOD LOW**
32		1010	**Surf Scoter**	MOD HIGH			MOD HIGH	**MOD HIGH**
32		1010	**White-winged Scoter**	MOD HIGH			MOD HIGH	**MOD HIGH**
32			**Bufflehead**	MODERATE			MOD HIGH	**MOD HIGH**
32			**Greater Scaup**	MODERATE			MOD HIGH	**MOD HIGH**
32			**Green-winged Teal**	MODERATE			MOD LOW	**MOD LOW**
32			**Northern Shoveler**	MODERATE			MOD HIGH	**MOD HIGH**
32			**Wood Duck**	MODERATE	MOD LOW	**MOD LOW**		
32			**Ruddy Duck**	MOD LOW			MOD HIGH	**MODERATE**
32.1			**Lesser Scaup**	HIGH			MOD HIGH	**HIGH**
32.1			**Mallard**	HIGH	MOD HIGH	**HIGH**	HIGH	**HIGHEST**
32.1			**Northern Pintail**	HIGH	MOD LOW	**MODERATE**	HIGH	**HIGHEST**
32.1			**American Wigeon**	MOD HIGH			HIGH	**HIGH**
32.1			**Blue-winged/CinnamonTeal**	MOD HIGH			MOD HIGH	**MOD HIGH**
32.1			**Canvasback**	MOD HIGH			MOD HIGH	**MOD HIGH**
32.1			**Surf Scoter**	MOD HIGH			MOD LOW	**MOD LOW**
32.1			**White-winged Scoter**	MOD HIGH			MOD LOW	**MOD LOW**
32.1			**Barrow's Goldeneye**	MODERATE			MOD LOW	**MOD LOW**
32.1			**Bufflehead**	MODERATE			MOD HIGH	**MOD HIGH**
32.1			**Gadwall**	MODERATE	MOD LOW	**MOD LOW**	MOD HIGH	**MOD HIGH**
32.1			**Greater Scaup**	MODERATE			MOD LOW	**MOD LOW**
32.1			**Green-winged Teal**	MODERATE			HIGH	**HIGH**
32.1			**Northern Shoveler**	MODERATE			HIGH	**HIGH**

32.1			Ring-necked Duck	MODERATE			MOD HIGH	MOD HIGH
	Pelagic WCRs			Continental	Breeding	Breeding	Nonbreeding	Nonbreeding
WCR	Breeding	NonBreeding	Species/Population	Priority	Importance	Need	Importance	Need
32.1			Wood Duck	MODERATE	MOD LOW	MOD LOW	MOD HIGH	MOD HIGH
32.1			Common Merganser	MOD LOW			MOD HIGH	MODERATE
32.1			Hooded Merganser	MOD LOW			MOD HIGH	MODERATE
32.1			Ruddy Duck	MOD LOW			HIGH	HIGH
33			Mallard	HIGH			MOD LOW	MODERATE
33			Northern Pintail	HIGH			MOD LOW	MODERATE
33			American Wigeon	MOD HIGH			MOD LOW	MOD LOW
33			Blue-winged/CinnamonTeal	MOD HIGH			MOD LOW	MOD LOW
33			Canvasback	MOD HIGH			MOD LOW	MOD LOW
33			Common Goldeneye	MOD HIGH			MOD LOW	MOD LOW
33			Redhead	MOD HIGH			MOD LOW	MOD LOW
33			Bufflehead	MODERATE			MOD LOW	MOD LOW
33			Gadwall	MODERATE			MOD LOW	MOD LOW
33			Green-winged Teal	MODERATE			MOD LOW	MOD LOW
33			Northern Shoveler	MODERATE			MOD LOW	MOD LOW
34			Mallard	HIGH			MOD LOW	MODERATE
34			Northern Pintail	HIGH			MOD LOW	MODERATE
34			Canvasback	MOD HIGH			MOD LOW	MOD LOW
34			Bufflehead	MODERATE			MOD LOW	MOD LOW
34			Gadwall	MODERATE			MOD LOW	MOD LOW
34			Green-winged Teal	MODERATE			MOD LOW	MOD LOW
34			Northern Shoveler	MODERATE			MOD LOW	MOD LOW
35			Mallard	HIGH			MOD LOW	MODERATE
35			Bufflehead	MODERATE			MOD LOW	MOD LOW
36			Lesser Scaup	HIGH			MOD LOW	MODERATE
36			Mallard	HIGH			MOD LOW	MODERATE
36			Northern Pintail	HIGH			MOD LOW	MODERATE
36			American Wigeon	MOD HIGH			MOD LOW	MOD LOW
36			Blue-winged/CinnamonTeal	MOD HIGH			MOD LOW	MOD LOW
36			Canvasback	MOD HIGH			MOD LOW	MOD LOW
36			Redhead	MOD HIGH			MOD HIGH	MOD HIGH
36			Bufflehead	MODERATE			MOD LOW	MOD LOW
36			Gadwall	MODERATE			MOD HIGH	MOD HIGH
36			Greater Scaup	MODERATE			MOD LOW	MOD LOW

36			Green-winged Teal	MODERATE			MOD LOW	MOD LOW
	Pelagic WCRs			Continental	Breeding	Breeding	Nonbreeding	Nonbreeding
WCR	Breeding	NonBreeding	Species/Population	Priority	Importance	Need	Importance	Need
36			Mottled Duck	MODERATE	MOD LOW	MOD LOW	MOD LOW	MOD LOW
36			Northern Shoveler	MODERATE			MOD LOW	MOD LOW
36			Ring-necked Duck	MODERATE			MOD LOW	MOD LOW
36			Black-bellied Whistling Duck	MOD LOW	MOD HIGH	MODERATE	MOD HIGH	MODERATE
36			Fulvous Whistling Duck	MOD LOW	MOD HIGH	MODERATE		
37			Lesser Scaup	HIGH			HIGH	HIGHEST
37			Mallard	HIGH			MOD HIGH	HIGH
37			Northern Pintail	HIGH			HIGH	HIGHEST
37			American Wigeon	MOD HIGH			HIGH	HIGH
37			Blue-winged Teal	MOD HIGH	MOD LOW	MOD LOW	HIGH	HIGH
37			Canvasback	MOD HIGH			MOD HIGH	MOD HIGH
37			Common Goldeneye	MOD HIGH			MOD HIGH	MOD HIGH
37			Redhead	MOD HIGH			HIGH	HIGH
37		1007	White-winged Scoter	MOD HIGH			MOD HIGH	MOD HIGH
37			Bufflehead	MODERATE			MOD HIGH	MOD HIGH
37			Gadwall	MODERATE			HIGH	HIGH
37			Greater Scaup	MODERATE			MOD HIGH	MOD HIGH
37			Green-winged Teal	MODERATE			HIGH	HIGH
37			Mottled Duck	MODERATE	HIGH	HIGH	HIGH	HIGH
37			Northern Shoveler	MODERATE			HIGH	HIGH
37			Ring-necked Duck	MODERATE			HIGH	HIGH
37			Wood Duck	MODERATE	MOD HIGH	MOD HIGH	MOD HIGH	MOD HIGH
37			Black-bellied Whistling Duck	MOD LOW	MOD HIGH	MODERATE	HIGH	HIGH
37			Fulvous Whistling Duck	MOD LOW	HIGH	HIGH	HIGH	HIGH
37			Hooded Merganser	MOD LOW			MOD HIGH	MODERATE
37			Red-breasted Merganser	MOD LOW			MOD HIGH	MODERATE
37			Ruddy Duck	MOD LOW			MOD HIGH	MODERATE
67			Hawaiian Duck	MODERATE	HIGH	HIGH	HIGH	HIGH
67			Laysan Duck	MODERATE	HIGH	HIGH	HIGH	HIGH
101			Northern Pintail	HIGH			MOD HIGH	HIGH
101			Lesser Scaup	HIGH			MOD LOW	MODERATE
101			American Wigeon	MOD HIGH			MOD LOW	MOD LOW

101			**Blue-winged Teal**	MOD HIGH			MOD LOW	**MOD LOW**
	Pelagic WCRs			**Continental**	**Breeding**	**Breeding**	**Nonbreeding**	**Nonbreeding**
WCR	**Breeding**	**NonBreeding**	**Species/Population**	**Priority**	**Importance**	**Need**	**Importance**	**Need**
101			**Canvasback**	MOD HIGH			MOD LOW	**MOD LOW**
101			**Cinnamon Teal**	MOD HIGH			MOD LOW	**MOD LOW**
101			**Redhead**	MOD HIGH			MOD HIGH	**MOD HIGH**
101			**Gadwall**	MODERATE			MOD HIGH	**MOD HIGH**
101			**Green-winged Teal**	MODERATE			MOD LOW	**MOD LOW**
101			**Northern Shoveler**	MODERATE			MOD LOW	**MOD LOW**
101			**Ring-necked Duck**	MODERATE			MOD LOW	**MOD LOW**
102			**Mallard**	HIGH			MOD HIGH	**HIGH**
102			**Lesser Scaup**	HIGH			MOD LOW	**MODERATE**
102			**Northern Pintail**	HIGH			HIGH	**HIGHEST**
102			**American Wigeon**	MOD HIGH			MOD LOW	**MOD LOW**
102			**Blue-winged Teal**	MOD HIGH			MOD HIGH	**MOD HIGH**
102			**Canvasback**	MOD HIGH			MOD HIGH	**MOD HIGH**
102			**Cinnamon Teal**	MOD HIGH			MOD HIGH	**MOD HIGH**
102			**Masked Duck**	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
102			**Redhead**	MOD HIGH			MOD HIGH	**MOD HIGH**
102			**Gadwall**	MODERATE			MOD HIGH	**MOD HIGH**
102			**Green-winged Teal**	MODERATE			MOD HIGH	**MOD HIGH**
102			**Northern Shoveler**	MODERATE			MOD HIGH	**MOD HIGH**
102			**Ring-necked Duck**	MODERATE			MOD HIGH	**MOD HIGH**
102			**Black-bellied Whistling Duck**	MOD LOW	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**
102			**Fulvous Whistling Duck**	MOD LOW	HIGH	**HIGH**	MOD HIGH	**MODERATE**
103			**Mallard**	HIGH			MOD HIGH	**HIGH**
103			**Lesser Scaup**	HIGH			MOD LOW	**MODERATE**
103			**Northern Pintail**	HIGH			HIGH	**HIGHEST**
103			**American Wigeon**	MOD HIGH			MOD LOW	**MOD LOW**
103			**Blue-winged Teal**	MOD HIGH			MOD HIGH	**MOD HIGH**
103			**Cinnamon Teal**	MOD HIGH			MOD LOW	**MOD LOW**
103			**Bufflehead**	MODERATE			MOD LOW	**MOD LOW**
103			**Gadwall**	MODERATE			MOD LOW	**MOD LOW**
103			**Green-winged Teal**	MODERATE			MOD HIGH	**MOD HIGH**
103			**Northern Shoveler**	MODERATE			MOD HIGH	**MOD HIGH**
103			**Ring-necked Duck**	MODERATE			MOD LOW	**MOD LOW**

WCR	Pelagic WCRs Breeding	Pelagic WCRs NonBreeding	Species/Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
103			**Wood Duck**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
103			**Mexican Duck**	MOD LOW	HIGH	**HIGH**	HIGH	**HIGH**
104			**Northern Pintail**	HIGH			MOD HIGH	**HIGH**
104			**American Wigeon**	MOD HIGH			MOD HIGH	**MOD HIGH**
104			**Blue-winged Teal**	MOD HIGH			MOD HIGH	**MOD HIGH**
104			**Canvasback**	MOD HIGH			MOD HIGH	**MOD HIGH**
104			**Cinnamon Teal**	MOD HIGH			HIGH	**HIGH**
104			**Muscovy Duck**	MOD HIGH			MOD LOW	**MOD LOW**
104			**Bufflehead**	MODERATE			MOD LOW	**MOD LOW**
104			**Gadwall**	MODERATE			MOD LOW	**MOD LOW**
104			**Green-winged Teal**	MODERATE			MOD HIGH	**MOD HIGH**
104			**Northern Shoveler**	MODERATE			MOD HIGH	**MOD HIGH**
104			**Mexican Duck**	MOD LOW	HIGH	**HIGH**	HIGH	**HIGH**
105			**Lesser Scaup**	HIGH			MOD HIGH	**HIGH**
105			**Northern Pintail**	HIGH			MOD LOW	**MODERATE**
105			**American Wigeon**	MOD HIGH			MOD LOW	**MOD LOW**
105			**Cinnamon Teal**	MOD HIGH			HIGH	**HIGH**
105			**Green-winged Teal**	MOD HIGH			MOD LOW	**MOD LOW**
105			**Masked Duck**	MOD HIGH	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
105			**Muscovy Duck**	MOD HIGH	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
105			**Bufflehead**	MODERATE			MOD LOW	**MOD LOW**
105			**Northern Shoveler**	MODERATE			MOD HIGH	**MOD HIGH**
105			**Black-bellied Whistling Duck**	MOD LOW	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**
105			**Fulvous Whistling Duck**	MOD LOW	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**
106			**Lesser Scaup**	HIGH			MOD HIGH	**HIGH**
106			**Northern Pintail**	HIGH			MOD HIGH	**HIGH**
106			**American Wigeon**	MOD HIGH			MOD HIGH	**MOD HIGH**
106			**Blue-winged Teal**	MOD HIGH			MOD HIGH	**MOD HIGH**
106			**Canvasback**	MOD HIGH			HIGH	**HIGH**
106			**Cinnamon Teal**	MOD HIGH			MOD HIGH	**MOD HIGH**
106			**Masked Duck**	MOD HIGH			MOD LOW	**MOD LOW**
106			**Muscovy Duck**	MOD HIGH	HIGH	**HIGH**	HIGH	**HIGH**
106			**Redhead**	MOD HIGH			HIGH	**HIGHEST**
106			**Gadwall**	MODERATE			MOD HIGH	**MOD HIGH**

WCR	Pelagic WCRs Breeding	Pelagic WCRs NonBreeding	Species/Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
106			**Green-winged Teal**	MODERATE			MOD HIGH	**MOD HIGH**
106			**Mottled Duck**	MODERATE	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
106			**Ring-necked Duck**	MODERATE			MOD HIGH	**MOD HIGH**
106			**Wood Duck**	MODERATE	MOD LOW	**MOD LOW**	MOD LOW	**MOD LOW**
106			**Black-bellied Whistling Duck**	MOD LOW	HIGH	**HIGH**	MOD HIGH	**MODERATE**
106			**Fulvous Whistling Duck**	MOD LOW	HIGH	**HIGH**	MOD HIGH	**MODERATE**
107			**Lesser Scaup**	HIGH			MOD LOW	**MODERATE**
107			**Northern Pintail**	HIGH			MOD LOW	**MODERATE**
107			**American Wigeon**	MOD HIGH			MOD HIGH	**MOD HIGH**
107			**Blue-winged Teal**	MOD HIGH			HIGH	**HIGH**
107			**Redhead**	MOD HIGH			MOD HIGH	**MOD HIGH**
107			**Gadwall**	MODERATE			MOD HIGH	**MOD HIGH**
107			**Green-winged Teal**	MODERATE			MOD HIGH	**MOD HIGH**
107			**Ring-necked Duck**	MODERATE			MOD HIGH	**MOD HIGH**
107			**Black-bellied Whistling Duck**	MOD LOW	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**
107			**Fulvous Whistling Duck**	MOD LOW	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**

Pelagic WCRs -

1001 - Arctic Shelf
1003 - Newfoundland-Labrador Shelf
1004 - Scotian Shelf
1005 - NE US Continental Shelf
1006 - SE US Continental Shelf
1007 - Gulf of Mexico
1008 - Pacific Central American Coastal
1009 - Gulf of California
1010 - Pacific Coastal
1011 - Gulf of Alaska
1012 - E. Bering Sea
1013 - W. Bering Sea
1014 - Chuckchi Sea
1015 - Beaufort Sea
1016 - Great Lakes

Combined prioritization for breeding and nonbreeding geese and swans

(empty cells indicate low conservation need or absence).

WCR	Species/Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
1	**Emperor Goose**	HIGH			HIGH	**HIGHEST**
1	**Western High Arctic Brant**	HIGH			MOD HIGH	**HIGH**
1	**Canada Goose - Aleutian**	MOD HIGH	HIGH	**HIGH**		
2	**Canada Goose - Cackling**	HIGH	HIGH	**HIGHEST**		
2	**Canada Goose - Lesser**	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
2	**Emperor Goose**	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
2	**Pacific Brant**	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
2	**Canada Goose - Aleutian**	MOD HIGH			HIGH	**HIGH**
2	**Lesser Snow Goose - Wrangel Island**	MOD HIGH			HIGH	**HIGH**
2	**Canada Goose - Taverner's**	MODERATE	HIGH	**HIGH**	HIGH	**HIGH**
2	**Tundra Swan - Eastern**	MOD LOW	HIGH	**HIGH**		
2	**Tundra Swan - Western**	MOD LOW	HIGH	**HIGH**		
2	**White-fronted Goose - Pacific Flyway**	MOD LOW	HIGH	**HIGH**	HIGH	**HIGH**
3	**Canada Goose - Atlantic**	HIGH	HIGH	**HIGHEST**		
3	**Canada Goose - Lesser**	HIGH	MOD HIGH	**HIGH**		
3	**Pacific Brant**	HIGH	HIGH	**HIGHEST**		
3	**Western High Arctic Brant**	HIGH	HIGH	**HIGHEST**		
3	**Eastern High Arctic Brant**	MOD HIGH	HIGH	**HIGH**		
3	**Canada Goose - Shortgrass Prairie**	MODERATE	HIGH	**HIGH**		
3	**Canada Goose - Taverner's**	MODERATE	HIGH	**HIGH**		
3	**Lesser Snow Goose - Western Central Flyway**	MODERATE	HIGH	**HIGH**		
3	**Atlantic Brant**	MOD LOW	HIGH	**HIGH**		
3	**Canada Goose - Tallgrass Prairie**	MOD LOW	HIGH	**HIGH**		
3	**Tundra Swan - Eastern**	MOD LOW	HIGH	**HIGH**		
3	**Tundra Swan - Western**	MOD LOW	HIGH	**HIGH**		
3	**White-fronted Goose - Mid-continent**	MOD LOW	HIGH	**HIGH**		
3	**Greater Snow Goose**	Above Objective	HIGH	**HIGH**	MOD HIGH	**MODERATE**
3	**Lesser Snow Goose - Mid-continent**	Above Objective	HIGH	**HIGH**		
3	**Lesser Snow Goose - Western Arctic**	Above Objective	HIGH	**HIGH**	HIGH	**HIGH**
3	**Ross's Goose**	Above Objective	HIGH	**HIGH**		

WCR	Species/Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
4	**Canada Goose - Lesser**	HIGH	HIGH	**HIGHEST**		
4	**White-fronted Goose - Tule**	HIGH	HIGH	**HIGHEST**		
4	**Lesser Snow Goose - Wrangel Island**	MOD HIGH			HIGH	**HIGH**
4	**Canada Goose - Taverner's**	MODERATE	MOD HIGH	**MOD HIGH**		
4	**Trumpeter Swan - Pacific Coast**	MOD LOW	HIGH	**HIGH**	HIGH	**HIGH**
4	**Tundra Swan - Western**	MOD LOW			HIGH	**HIGH**
4	**White-fronted Goose - Mid-continent**	MOD LOW	HIGH	**HIGH**		
5	**Canada Goose - Cackling**	HIGH			HIGH	**HIGHEST**
5	**Canada Goose - Dusky**	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
5	**Canada Goose - Lesser**	HIGH			HIGH	**HIGHEST**
5	**Emperor Goose**	HIGH			MOD LOW	**MODERATE**
5	**Pacific Brant**	HIGH			HIGH	**HIGHEST**
5	**Western High Arctic Brant**	HIGH			HIGH	**HIGHEST**
5	**Canada Goose - Aleutian**	MOD HIGH			HIGH	**HIGH**
5	**Lesser Snow Goose - Wrangel Island**	MOD HIGH			HIGH	**HIGH**
5	**Canada Goose - Pacific**	MODERATE	HIGH	**HIGH**	MOD HIGH	**MOD HIGH**
5	**Canada Goose - Taverner's**	MODERATE			HIGH	**HIGH**
5	**Canada Goose - Vancouver**	MODERATE	HIGH	**HIGH**	HIGH	**HIGH**
5	**Trumpeter Swan - Pacific Coast**	MOD LOW	HIGH	**HIGH**	HIGH	**HIGH**
5	**Tundra Swan - Western**	MOD LOW			HIGH	**HIGH**
5	**White-fronted Goose - Pacific Flyway**	MOD LOW	MOD HIGH	**MODERATE**	HIGH	**HIGH**
5	**Lesser Snow Goose - Western Arctic**	Above Objective			MOD HIGH	**MODERATE**
6	**Trumpeter Swan - Rocky Mountain**	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
6	**Lesser Snow Goose - Wrangel Island**	MOD HIGH			MOD HIGH	**MOD HIGH**
6	**Canada Goose - Shortgrass Prairie**	MODERATE	MOD HIGH	**MOD HIGH**		
6	**Lesser Snow Goose - Western Central Flyway**	MODERATE			HIGH	**HIGH**
6	**Canada Goose - Eastern Prairie**	MOD LOW			MOD HIGH	**MODERATE**
6	**Canada Goose - Rocky Mountain**	MOD LOW			MOD HIGH	**MODERATE**
6	**Tundra Swan - Eastern**	MOD LOW			HIGH	**HIGH**
6	**Tundra Swan - Western**	MOD LOW			HIGH	**HIGH**
6	**White-fronted Goose - Mid-continent**	MOD LOW			MOD HIGH	**MODERATE**
6	**Lesser Snow Goose - Western Arctic**	Above Objective			HIGH	**HIGH**
6	**Ross's Goose**	Above Objective			HIGH	**HIGH**
6.1	**Canada Goose - Shortgrass Prairie**	MODERATE	HIGH	**HIGH**		
7	**Canada Goose - Atlantic**	HIGH	HIGH	**HIGHEST**		

WCR	Species/Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
7	**Canada Goose - North Atlantic**	MOD HIGH	HIGH	**HIGH**		
7	**Atlantic Brant**	MOD LOW			HIGH	**HIGH**
7	**Canada Goose - Mississippi Flyway Giant**	Above Objective			MOD HIGH	**MODERATE**
7.1	**Canada Goose - Southern James Bay**	HIGH	HIGH	**HIGHEST**		
7.1	**Canada Goose - Mississippi Valley**	MODERATE	HIGH	**HIGH**		
7.1	**Atlantic Brant**	MOD LOW			HIGH	**HIGH**
7.1	**Canada Goose - Mississippi Flyway Giant**	Above Objective			MOD HIGH	**MODERATE**
7.1	**Lesser Snow Goose - Mid-continent**	Above Objective	MOD HIGH	**MODERATE**	HIGH	**HIGH**
7.2	**Canada Goose - Eastern Prairie**	MOD LOW	HIGH	**HIGH**		
7.2	**Canada Goose - Mississippi Flyway Giant**	Above Objective			HIGH	**HIGH**
7.2	**Canada Goose - Western Prairie/Great Plains**	Above Objective	HIGH	**HIGH**		
7.2	**Lesser Snow Goose - Mid-continent**	Above Objective	MOD HIGH	**MODERATE**	HIGH	**HIGH**
8	**Canada Goose - Atlantic**	HIGH	MOD LOW	**MODERATE**		
8	**Canada Goose - North Atlantic**	MOD HIGH	MOD HIGH	**MOD HIGH**		
8	**Canada Goose - Mississippi Flyway Giant**	Above Objective			MOD HIGH	**MODERATE**
8.1	**Canada Goose - Southern James Bay**	HIGH			MOD LOW	**MODERATE**
8.1	**Canada Goose - Mississippi Flyway Giant**	Above Objective			MOD HIGH	**MODERATE**
8.1	**Canada Goose - Western Prairie/Great Plains**	Above Objective	HIGH	**HIGH**		
8.2	**Canada Goose - North Atlantic**	MOD HIGH	HIGH	**HIGH**		
9	**Canada Goose - Cackling**	HIGH			MOD HIGH	**HIGH**
9	**Canada Goose - Lesser**	HIGH			HIGH	**HIGHEST**
9	**Trumpeter Swan - Rocky Mountain**	HIGH	MOD HIGH	**HIGH**	MOD HIGH	**HIGH**
9	**White-fronted Goose - Tule**	HIGH			HIGH	**HIGHEST**
9	**Canada Goose - Aleutian**	MOD HIGH			HIGH	**HIGH**
9	**Lesser Snow Goose - Wrangel Island**	MOD HIGH			HIGH	**HIGH**
9	**Canada Goose - Pacific**	MODERATE			HIGH	**HIGH**
9	**Canada Goose - Taverner's**	MODERATE			HIGH	**HIGH**
9	**Canada Goose - Rocky Mountain**	MOD LOW			HIGH	**HIGH**
9	**Tundra Swan - Western**	MOD LOW			HIGH	**HIGH**
9	**White-fronted Goose - Pacific Flyway**	MOD LOW			HIGH	**HIGH**
9	**Lesser Snow Goose - Western Arctic**	Above Objective			MOD HIGH	**MODERATE**
9	**Ross's Goose**	Above Objective			MOD HIGH	**MODERATE**
10	**Canada Goose - Lesser**	HIGH			MOD HIGH	**HIGH**
10	**Trumpeter Swan - Rocky Mountain**	HIGH	MOD LOW	**MODERATE**	MOD LOW	**MODERATE**
10	**Canada Goose - Pacific**	MODERATE			HIGH	**HIGH**

WCR	Species/Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
10	**Canada Goose - Taverner's**	MODERATE			MOD HIGH	**MOD HIGH**
10	**Canada Goose - Rocky Mountain**	MOD LOW	HIGH	**HIGH**	MOD HIGH	**MODERATE**
10	**Trumpeter Swan - Pacific Coast**	MOD LOW			MOD HIGH	**MODERATE**
10	**Tundra Swan - Western**	MOD LOW			HIGH	**HIGH**
11	**Lesser Snow Goose - Wrangel Island**	MOD HIGH			MOD HIGH	**MOD HIGH**
11	**Canada Goose - Shortgrass Prairie**	MODERATE			HIGH	**HIGH**
11	**Lesser Snow Goose - Western Central Flyway**	MODERATE			HIGH	**HIGH**
11	**Trumpeter Swan - Interior**	MODERATE	HIGH	**HIGH**	HIGH	**HIGH**
11	**Canada Goose - Eastern Prairie**	MOD LOW			HIGH	**HIGH**
11	**Canada Goose - Rocky Mountain**	MOD LOW	MOD HIGH	**MODERATE**		
11	**Canada Goose - Tallgrass Prairie**	MOD LOW			HIGH	**HIGH**
11	**Tundra Swan - Eastern**	MOD LOW			HIGH	**HIGH**
11	**Tundra Swan - Western**	MOD LOW			MOD HIGH	**MODERATE**
11	**White-fronted Goose - Mid-continent**	MOD LOW			HIGH	**HIGH**
11	**Canada Goose - Hi-Line**	Above Objective	HIGH	**HIGH**		
11	**Canada Goose - Mississippi Flyway Giant**	Above Objective	HIGH	**HIGH**	HIGH	**HIGH**
11	**Canada Goose - Western Prairie/Great Plains**	Above Objective	HIGH	**HIGH**	HIGH	**HIGH**
11	**Lesser Snow Goose - Mid-continent**	Above Objective			HIGH	**HIGH**
11	**Lesser Snow Goose - Western Arctic**	Above Objective			HIGH	**HIGH**
11	**Ross's Goose**	Above Objective			HIGH	**HIGH**
12	**Canada Goose - Atlantic**	HIGH			MOD HIGH	**HIGH**
12	**Canada Goose - Southern James Bay**	HIGH			MOD HIGH	**HIGH**
12	**Canada Goose - Mississippi Valley**	MODERATE			MOD LOW	**MOD LOW**
12	**Canada Goose - Mississippi Flyway Giant**	Above Objective	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**
13	**Canada Goose - Atlantic**	HIGH			HIGH	**HIGHEST**
13	**Canada Goose - Southern James Bay**	HIGH			HIGH	**HIGHEST**
13	**Atlantic Brant**	MOD LOW			MOD LOW	**MOD LOW**
13	**Tundra Swan - Eastern**	MOD LOW			MOD HIGH	**MODERATE**
13	**Canada Goose - Mississippi Flyway Giant**	Above Objective	HIGH	**HIGH**	MOD HIGH	**MODERATE**
13	**Greater Snow Goose**	Above Objective			HIGH	**HIGH**
14	**Canada Goose - North Atlantic**	MOD HIGH			HIGH	**HIGH**
14	**Atlantic Brant**	MOD LOW			MOD HIGH	**MODERATE**
16	**Trumpeter Swan - Rocky Mountain**	HIGH	MOD HIGH	**HIGH**	MOD HIGH	**HIGH**
16	**Canada Goose - Rocky Mountain**	MOD LOW			MOD HIGH	**MODERATE**
16	**Tundra Swan - Western**	MOD LOW			MOD HIGH	**MODERATE**

WCR	Species/Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
17	**Lesser Snow Goose - Wrangel Island**	MOD HIGH			MOD HIGH	**MOD HIGH**
17	**Canada Goose - Shortgrass Prairie**	MODERATE			MOD HIGH	**MOD HIGH**
17	**Trumpeter Swan - Interior**	MODERATE	HIGH	**HIGH**	HIGH	**HIGH**
17	**Canada Goose - Hi-Line**	Above Objective			MOD HIGH	**MODERATE**
17	**Canada Goose - Western Prairie/Great Plains**	Above Objective	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**
17	**Lesser Snow Goose - Western Arctic**	Above Objective			MOD HIGH	**MODERATE**
17	**Ross's Goose**	Above Objective			MOD HIGH	**MODERATE**
18	**Canada Goose - Shortgrass Prairie**	MODERATE			HIGH	**HIGH**
18	**Lesser Snow Goose - Western Central Flyway**	MODERATE			HIGH	**HIGH**
18	**Canada Goose - Hi-Line**	Above Objective	MOD HIGH	**MODERATE**	HIGH	**HIGH**
18	**Ross's Goose**	Above Objective			MOD HIGH	**MODERATE**
19	**Canada Goose - Shortgrass Prairie**	MODERATE			MOD LOW	**MOD LOW**
19	**Lesser Snow Goose - Western Central Flyway**	MODERATE			HIGH	**HIGH**
19	**Canada Goose - Tallgrass Prairie**	MOD LOW			MOD HIGH	**MODERATE**
19	**White-fronted Goose - Mid-continent**	MOD LOW			HIGH	**HIGH**
19	**Canada Goose - Western Prairie/Great Plains**	Above Objective	HIGH	**HIGH**	HIGH	**HIGH**
19	**Lesser Snow Goose - Mid-continent**	Above Objective			HIGH	**HIGH**
19	**Ross's Goose**	Above Objective			MOD HIGH	**MODERATE**
21	**Canada Goose - Tallgrass Prairie**	MOD LOW			HIGH	**HIGH**
21	**White-fronted Goose - Mid-continent**	MOD LOW			MOD HIGH	**MODERATE**
21	**Canada Goose - Western Prairie/Great Plains**	Above Objective			MOD HIGH	**MODERATE**
21	**Lesser Snow Goose - Mid-continent**	Above Objective			MOD HIGH	**MODERATE**
22	**Canada Goose - Southern James Bay**	HIGH			MOD LOW	**MODERATE**
22	**Canada Goose - Mississippi Valley**	MODERATE			HIGH	**HIGH**
22	**Canada Goose - Eastern Prairie**	MOD LOW			HIGH	**HIGH**
22	**Canada Goose - Tallgrass Prairie**	MOD LOW			MOD LOW	**MOD LOW**
22	**Canada Goose - Mississippi Flyway Giant**	Above Objective	HIGH	**HIGH**	MOD HIGH	**MODERATE**
22	**Canada Goose - Western Prairie/Great Plains**	Above Objective	MOD HIGH	**MODERATE**	HIGH	**HIGH**
22	**Lesser Snow Goose - Mid-continent**	Above Objective			HIGH	**HIGH**
23	**Canada Goose - Southern James Bay**	HIGH			HIGH	**HIGHEST**
23	**Canada Goose - Mississippi Valley**	MODERATE			HIGH	**HIGH**
23	**Trumpeter Swan - Interior**	MODERATE	MOD HIGH	**MOD HIGH**	MOD HIGH	**MOD HIGH**
23	**Tundra Swan - Eastern**	MOD LOW			HIGH	**HIGH**
23	**Canada Goose - Mississippi Flyway Giant**	Above Objective	HIGH	**HIGH**	MOD HIGH	**MODERATE**
24	**Canada Goose - Southern James Bay**	HIGH			MOD HIGH	**HIGH**

WCR	Species/Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
24	**Canada Goose - Mississippi Valley**	MODERATE			HIGH	**HIGH**
24	**Canada Goose - Eastern Prairie**	MOD LOW			MOD LOW	**MOD LOW**
24	**Canada Goose - Mississippi Flyway Giant**	Above Objective	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**
25	**Lesser Snow Goose - Mid-continent**	Above Objective			MOD HIGH	**MODERATE**
26	**Canada Goose - Mississippi Valley**	MODERATE			MOD LOW	**MOD LOW**
26	**Lesser Snow Goose - Mid-continent**	Above Objective			MOD HIGH	**MODERATE**
27	**Canada Goose - Southern James Bay**	HIGH			MOD LOW	**MODERATE**
27.1	**Canada Goose - Atlantic**	HIGH			MOD HIGH	**HIGH**
27.1	**Atlantic Brant**	MOD LOW			MOD HIGH	**MODERATE**
27.1	**Tundra Swan - Eastern**	MOD LOW			HIGH	**HIGH**
27.1	**Greater Snow Goose**	Above Objective			HIGH	**HIGH**
28	**Canada Goose - Atlantic**	HIGH			MOD HIGH	**HIGH**
29	**Canada Goose - Atlantic**	HIGH			MOD HIGH	**HIGH**
30	**Canada Goose - Atlantic**	HIGH			HIGH	**HIGHEST**
30	**Canada Goose - North Atlantic**	MOD HIGH			HIGH	**HIGH**
30	**Atlantic Brant**	MOD LOW			HIGH	**HIGH**
30	**Tundra Swan - Eastern**	MOD LOW			HIGH	**HIGH**
30	**Canada Goose - Mississippi Flyway Giant**	Above Objective	MOD HIGH	**MODERATE**	MOD HIGH	**MODERATE**
30	**Greater Snow Goose**	Above Objective			HIGH	**HIGH**
32	**Pacific Brant**	HIGH			HIGH	**HIGHEST**
32.1	**Canada Goose - Cackling**	HIGH			MOD HIGH	**HIGH**
32.1	**White-fronted Goose - Tule**	HIGH			HIGH	**HIGHEST**
32.1	**Canada Goose - Aleutian**	MOD HIGH			HIGH	**HIGH**
32.1	**Lesser Snow Goose - Wrangel Island**	MOD HIGH			HIGH	**HIGH**
32.1	**Canada Goose - Pacific**	MODERATE			MOD HIGH	**MOD HIGH**
32.1	**Canada Goose - Rocky Mountain**	MOD LOW			MOD LOW	**MOD LOW**
32.1	**Tundra Swan - Western**	MOD LOW			HIGH	**HIGH**
32.1	**White-fronted Goose - Pacific Flyway**	MOD LOW			HIGH	**HIGH**
32.1	**Lesser Snow Goose - Western Arctic**	Above Objective			HIGH	**HIGH**
32.1	**Ross's Goose**	Above Objective			HIGH	**HIGH**
33	**Trumpeter Swan - Rocky Mountain**	HIGH			MOD LOW	**MODERATE**
36	**White-fronted Goose - Mid-continent**	MOD LOW			MOD HIGH	**MODERATE**
37	**Canada Goose - Tallgrass Prairie**	MOD LOW			HIGH	**HIGH**
37	**White-fronted Goose - Mid-continent**	MOD LOW			HIGH	**HIGH**
37	**Lesser Snow Goose - Mid-continent**	Above Objective			HIGH	**HIGH**

WCR	Species/Population	Continental Priority	Breeding Importance	Breeding Need	Nonbreeding Importance	Nonbreeding Need
67	**Hawaiian Goose**	HIGH	HIGH	**HIGHEST**	HIGH	**HIGHEST**
101	**Pacific Brant**	HIGH			HIGH	**HIGHEST**
101	**Lesser Snow Goose - Western Central Flyway**	MODERATE			MOD LOW	**MOD LOW**
101	**White-fronted Goose - Mid-continent**	MOD LOW			MOD HIGH	**MODERATE**
101	**White-fronted Goose - Pacific Flyway**	MOD LOW			MOD HIGH	**MODERATE**
102	**Pacific Brant**	HIGH			MOD HIGH	**HIGH**
102	**Lesser Snow Goose - Western Central Flyway**	MODERATE			HIGH	**HIGH**
102	**White-fronted Goose - Mid-continent**	MOD LOW			MOD HIGH	**MODERATE**
102	**White-fronted Goose - Pacific Flyway**	MOD LOW			MOD HIGH	**MODERATE**
103	**Lesser Snow Goose - Western Central Flyway**	MODERATE			HIGH	**HIGH**
103	**White-fronted Goose - Mid-continent**	MOD LOW			MOD HIGH	**MODERATE**
103	**White-fronted Goose - Pacific Flyway**	MOD LOW			MOD HIGH	**MODERATE**
103	**Lesser Snow Goose - Mid-continent**	Above Objective			MOD HIGH	**MODERATE**
106	**White-fronted Goose - Mid-continent**	MOD LOW			MOD HIGH	**MODERATE**
106	**Lesser Snow Goose - Mid-continent**	Above Objective			MOD HIGH	**MODERATE**

Appendix C: Institutional, Legal and Administrative Authorities, Functions, and Arrangements

Plan Committee

The North American Waterfowl Management Plan Committee is an international body that provides leadership and oversight for the activities undertaken in support of the North American Waterfowl Management Plan.

Leadership

Taking advice from all Plan partners and the NSST, the Plan Committee's scientific arm, provides continuous leadership to promote synergies within the North American waterfowl community, across relevant sectors, and internationally by:

- Championing waterfowl conservation in the context of coordinated bird management, while maintaining a strong waterfowl focus.
- Enhancing communications on waterfowl conservation and coordination within North America, and with other nations that share North American waterfowl.
- Continually scanning the institutional network influencing waterfowl conservation and seeking ways to foster synergy among them.
- Promoting the development and assessment of continental waterfowl population objectives and species and geographic priorities through development and dissemination of the Plan document.
- Liaising with the broader scientific community and ensuring that the Plan - and its scientific arm, the NSST - link effectively and operationally with relevant scientific authorities such as the joint venture technical committees, Flyway Councils, and federal, state and provincial agencies, to relevant scientific data as available to strengthen the biological foundation for waterfowl conservation.
- Serving as a forum for discussion of major, long-term international waterfowl issues and problems, and translating those discussions into recommendations for consideration by the cooperating partners and countries.
- Directing waterfowl-related recommendations emerging from joint ventures, Flyway Councils and other Plan fora to the Canadian Wildlife Service, the U.S. Fish and Wildlife Service, and the General Directorate of Wildlife of the Secretariat of Environment and Natural Resources in Mexico, and feeding back information from those agencies to the Plan community.

Plan Management

The Plan Committee has oversight responsibility for assuring the quality of Plan actions and the overall effectiveness of the Plan. The Committee also needs to be able to report on the impact of Plan funding and activities. To meet these obligations, the Committee orchestrates Plan community resources to:

- Review and monitor progress toward achieving the Plan's population goals and related habitat objectives.
- Update the Plan approximately every 5 years in response to new or changing circumstances, policy developments, or opportunities.
- Foster an adaptive management approach among joint ventures in conservation implementation.
- Promote quality assurance within the Plan management units by:
    - reviewing and endorsing waterfowl conservation components of joint venture plans;
    - reviewing implementation and evaluation strategies developed by joint venture or other regional partnerships;
    - reviewing periodic joint venture reports to ensure joint venture activities effectively further the Plan's purposes; and
    - Encourage coordination and consensus among joint ventures and other relevant bodies concerning waterfowl conservation needs, biological planning, monitoring, and assessment.

- Maintain and promote strong relationships with Flyway Councils, wetland councils, the North American Bird Conservation Initiative's Trilateral Committee, and other bird initiatives.

- Host periodic conferences for the NSST, joint ventures, and Plan partners to discuss improvements to the Plan's biological foundation.

- Annually solicit joint ventures and other Plan partners for input on the status of Plan implementation and issues to be addressed by the Plan Committee.

- Prepare periodic reports on the status of Plan implementation for the 3 federal wildlife agencies using input from the joint ventures and the NSST.

- Review periodically - in the spirit of adaptive management promoted in this Update - the Plan Committee's own effectiveness and consider structural, relational, and management approaches to enhance Committee impact.

Membership

The Plan Committee consists of 18 members, six from each country, selected from agencies responsible for waterfowl management in Canada, the United States, and Mexico. Members are appointed by the director of the federal wildlife agency in the respective country.

NAWMP Science Support Team **(NSST)**

The Plan Committee created the NAWMP Science Support Team (NSST) in 2000 to provide technical advice to the Plan Committee. Its mission is **"To help strengthen the biological foundations of Plan, and facilitate continuous improvement of Plan conservation programs."** The team accomplishes this primarily by promoting adaptive management at both the continental and joint venture levels.

The NSST provides six major services to the Plan:

1. *Provides technical input and recommendations to the Plan Committee on Plan implementation.* This includes periodically reviewing Plan population objectives, species priorities, geographic priorities, and habitat objectives; providing input on Plan updates; technical assistance in crafting broad-scale implementation strategies for the Plan; and helping interpret long-term implications of climate changes, agro-economic trends, policy impacts, and other global dynamics for the future of waterfowl conservation.

2. *Facilitates identification of methods for biological planning and for evaluating Plan performance at continental and regional scales.* This includes assisting regional Plan partnerships with stepping down continental population objectives and the development of habitat objectives; assisting regional partnerships in developing a better understanding of the effects of habitat variation on population demography in order to link regional habitat objectives to continental population objectives; and assessing Plan progress while accounting for uncontrolled environmental variation. Methodological contributions could include identifyng common currencies and definitions for inter-joint venture planning, and seeking standardization and integration in survey and data management protocols for habitat and population monitoring.

3. *Acts as a forum for discussions on, and integration of biological planning and evaluation at multiple spatial scales.* This includes improving the coordination of national, continental and regional biological planning, monitoring, and assessment, as well as identification of broad-scale information gaps and technical issues beyond the scope of individual joint ventures.

4. *Facilitates technical information exchange and reporting among joint ventures and the Plan Committee.* The NSST helps to improve technical information exchange among joint ventures, between the Plan Committee and the joint ventures, among the Flyways and the Plan community, and between the North American Wetlands Conservation Council(s) and the Plan community.

5. *Helps identify and communicate data, monitoring, assessment, and research needs to U.S. Geologic Service-BRD, academia, U.S. Fish and Wildlife Service, and other Plan partners* The NSST helps to identify research, assessment, and monitoring needs and enables objective comparison of evaluation investment options. It facilitates technical integration with the Flyway system and other bird initiatives on issues of common interest.

6. *Reports annually to the Plan Committee and Plan partners on the status of Plan biological*

foundation, evaluation results, and implications for future conservation activities. The Plan Committee intends to begin regular reviews of joint venture progress in attaining the regional goals and objectives of the Plan. In support of these periodic reviews, the NSST will receive, consolidate, and assess regional progress reports and make related recommendations to the Plan Committee.

Membership

The NSST consists of three national representatives appointed by the Plan Committee Co-Chairs, and one technical representative from each of the joint ventures and Flyway Councils. Ad-hoc members may also be appointed by the Co-Chairs of the Plan Committee.

Joint Ventures

"Think Continentally; Act Locally" is one concept that led to the creation of joint ventures by Plan founders. They recognized that success could only be achieved through the collaborative efforts of a range of public and private organizations, coordinated through a continental vision, energized by local passion, and informed by resident expertise. In Canada and the United States, where there has been a strong history of closely coordinated conservation actions by governments and several non-government organizations, formal partnerships, termed joint ventures, have been formed to help implement the Plan. Joint ventures are planning and adaptive management focal points; the crystallizing agents that convene diverse interest to restore and protect habitat; and the fora to discuss and advocate for a partnership approach at the local level. The biological foundation components of joint venture perspectives that deal with waterfowl population goals and related habitat objectives are sanctioned by the Plan Committee and are accountable to the Plan Committee for meeting their responsibilities towards achievement of Plan objectives. In recent years, with the planning for all bird conservation in North America, many joint ventures have adopted a structure, objectives and operations to accommodate conservation initiatives that will foster all bird conservation.

Two types of joint ventures currently operating:

- *Habitat* joint ventures are the fundamental regional conservation units of the Plan. They are comprised of diverse stakeholders committed to waterfowl conservation in a specific area, identified as one of the Plan's priority habitats. They were formed in response to research that indicated habitat loss and degradation was the cause of decline for many waterfowl species during the mid-1980's. Additional habitat joint ventures can be formed when formal partnerships for waterfowl habitat conservation develop in other areas of concern.

- *Species* joint ventures focus on knowledge acquisition that supports management actions. Black Duck and Arctic Goose Joint Ventures were specified in the original Plan to address concerns about the status of populations, rectify the lack of data to specify the nature of the problem, or to design management solutions. The Sea Duck Joint Venture began in 1998 for much the same reason. Species joint ventures are comprised of agencies capable of contributing effort, talent, and financial resources toward coordinated scientific activity. Research results are fed into the planning of habitat joint ventures. Additional species joint ventures can be considered wherever a significant science need is identified, together with a proposed coalition of partners.

Joint ventures resemble Plan "franchises": autonomous units which voluntarily subscribe to the Plan's vision and principles and are responsible for adhering to Plan principles, objectives, and priorities in the implementation of regional and local conservation efforts once their waterfowl conservation objectives are sanctioned by the Plan Committee. Each joint venture is overseen by its own management body, develops a strategic implementation and evaluation plan, and organizes completion of its tasks through various support committees. Habitat joint ventures "step-down" the Plan’s continental population objectives to develop regional habitat objectives using sound science enhanced with local knowledge, and an evaluation of local opportunities and conservation dynamics. A joint venture's management interventions are expected to be strategic, science-based, and molded through adaptive management. Plan Committee endorsement of a joint venture's implementation plan can greatly facilitate recruitment of various institutional, financial, and human resources to achieve habitat objectives which, in turn, sustain important segments of the overall Plan conservation quilt. Joint ventures report annually to the Plan Committee and Plan Partners on the status of joint venture activities, challenges, and accomplishments.

Existing joint ventures that have a waterfowl conservation component endorsed by the Plan Committee, together with the country in which they function and the year in which they were established, are listed below:

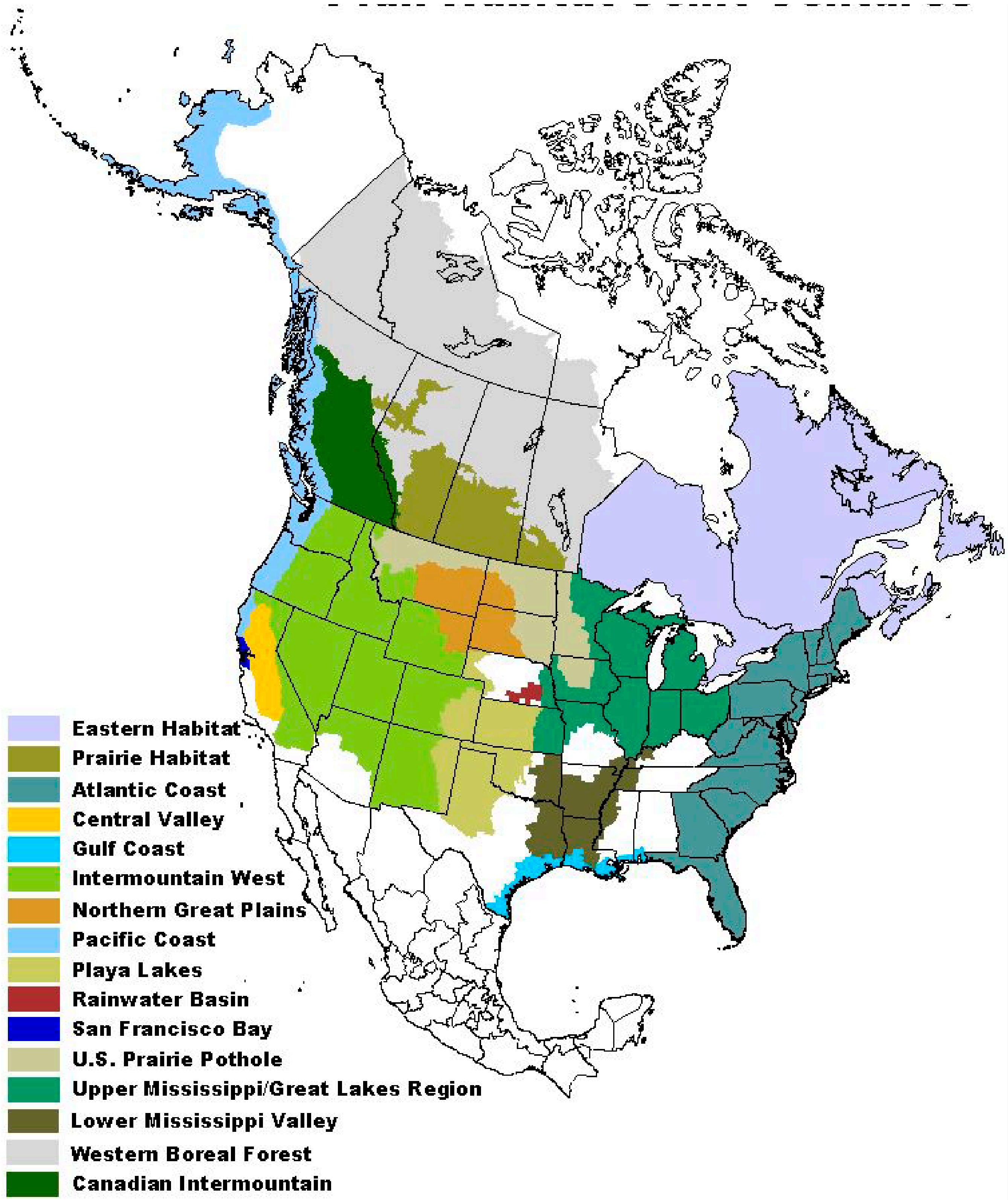
Habitat Joint Ventures

Atlantic Coast (U.S.: 1986)
Central Valley Habitat (U.S.: 1986)
Eastern Habitat (Canada: 1986)
Gulf Coast (U.S.: 1986)
Lower Mississippi Valley (U.S.: 1986)
Prairie Habitat (Canada: 1986)
Prairie Pothole (U.S; 1986)
Intermountain West (U.S.: 1992)
Pacific Coast (U.S. & Canada: 1992)
Playa Lakes (U.S.: 1992)
Rainwater Basin (U.S.: 1992)
Upper Mississippi River - Great Lakes Region (U.S.: 1992)
San Francisco Bay (U.S.: 2000)
Canadian Intermountain (Canada: 2003) ??
Northern Great Plains (U.S.) ??

Species Joint Ventures

Arctic Goose (U.S. & Canada: 1986)
Black Duck (U.S. & Canada: 1986)
Sea Duck (U.S. & Canada: 1999)

Figure 6. NAWMP Joint Ventures. [7]



[7] Northern Great Plains, Canadian Intermountain, and Western Boreal have not yet been reviewed and endorsed by the International Plan Committee

National Administration

Canada

In Canada, the Plan is administered by the North American Wetlands Conservation Council (NAWCC) Canada, which is now a component of the North American Bird Conservation Initiative (NABCI) Canada Council. Working with the NAWCC in the United States and the National Institute of Ecology in Mexico, the NAWCC (Canada) advises the Minister of the Environment through the NABCI Canada Council on the development, coordination, and implementation of wetland conservation initiatives of national or international importance. It also coordinates development of all habitat joint venture submissions for funding and acts as a window to the U.S. funding process.

National coordination is provided by the North American Waterfowl Management Plan Implementation Office, Canadian Wildlife Service, Environment Canada, and the Secretariat of NABCI/NAWCC (Canada). These offices provide funding support; maintain an accomplishment tracking system; provide input into Birdscapes, an international habitat magazine (in cooperation with Mexico and the United States); coordinate the production of an annual report entitled "Canadian Habitat Matters"; publish the Plan Partners Contact List; assist in implementation of the Plan Awards Program; and, coordinate with joint ventures and the provinces to achieve Plan goals in Canada.

The Canadian Wildlife Service also coordinates a number of other national level plans which compliment aspects of the Plan. These include involvement in regulations that control the hunting of migratory game birds under the Migratory Birds Convention Act; the Convention on Wetlands of International Importance (Ramsar); the Habitat Stewardship Program; the Canadian Species at Risk Program; and, research on a wide variety of wildlife topics, particularly migratory birds.

Joint venture management boards and provincial steering committees have formed many partnerships. Canadian partners include the federal government, all provincial governments and numerous government agencies (including the Flyway Councils), conservation organizations, municipalities, corporations, and landowners. These partners are directly responsible for designing, implementing, and monitoring programs and projects across the country.

United States

In the United States, the Plan has become a network of partnerships that connects the various elements of the waterfowl conservation community. State and federal governments, the Flyway Councils, corporations, organizations, and individuals all have important roles in attaining the vision and goals of the Plan. The nexus of these efforts is the regional joint venture. Joint ventures are self-directed partnerships of agencies, organizations, corporations, tribes, or individuals that connect diverse programs aimed at migratory bird and habitat conservation on public and private lands.

Public-lands management is directed at acquiring high-priority public lands and restoring, enhancing, and managing habitats on existing lands. Partners include all of the states that participate in a joint venture and most of the major federal land-management agencies, such as the U.S. Fish and Wildlife Service's National Wildlife Refuge System, the Bureaus of Land Management, Reclamation, and Indian Affairs, the Department of Agriculture Forest Service, and the Department of Defense.

Private-lands management is directed at improving wetland, grassland, and forest habitats for waterfowl. Private lands are conserved through a diverse network of programs and partnerships, including the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife, corporate partnerships, private-lands programs conducted by conservation organizations, state wildlife conservation programs, and federal programs such as the Department of Agriculture's Wetlands Reserve Program, Wildlife Habitat Incentive Program, Conservation Reserve Program, and the Environmental Quality Improvement Program.

National coordination of the Plan is provided by the Service's Division of Bird Habitat Conservation (formerly the North American Waterfowl and Wetlands Office). It provides funding support; maintains an accomplishment tracking system; conducts national evaluation activities; publishes Birdscapes (in cooperation with Canada and Mexico), annual progress reports, and other reports; and coordinates with other federal agencies and the U.S. Congress.

Mexico

In Mexico, conservation under the Plan is coordinated through the General Directorate of Wildlife of the Secretariat of Environment and Natural Resources (SEMARNAT). Conservation efforts are directed at improving the overall conditions of wetland ecosystems within a framework of the great wealth of Mexico's biological diversity and guided by the National Plan for the Conservation, Management and Rational Use of Waterfowl and their Habitats in Mexico. This plan is being developed by the Subcommittee on Waterfowl and their Habitats in Mexico, an advisory group to the General Directorate of Wildlife, to guide conservation initiatives in the conservation of waterfowl and their habitats.

The economic importance of waterfowl is relatively small in Mexico, and is dwarfed by the economic and social importance of all aspects of biological resources. Conservation projects are developed, implemented, and managed in cooperation with national and local NGOs and with the involvement of the local communities. Conservation education is an integral part of conservation delivery. Developing sustainable uses of wetlands and associated wildlife at a regional basis, and working with local communities to develop and implement management plans, are high priorities.

Prioritization of wetlands with respect to importance for waterfowl is based on the National Plan. This document will provide the regional framework to guide future conservation initiatives and specific actions to secure the conservation of the wetlands ecosystems and associated wildlife. This work will be implemented regionally through local partnerships.

Authorities, Jurisdictions, and Linkages

Several landmark agreements establish the legal foundation for conservation of waterfowl in

North America. The *Convention for the Protection of Migratory Birds* (Migratory Bird Treaty) between the United States and Great Britain (for Canada) in 1916 mandated the first federal responsibility for managing waterfowl resources in North America across international boundaries. Under this treaty - and subsequent treaties between the U.S. and Mexico in 1936, Japan in 1972, and the Soviet Union in 1978 - international cooperation and protection for migratory waterfowl and their habitats was greatly expanded. Implementation of these treaties, through enabling legislation in each country, established policy frameworks to regulate hunting and other uses while ensuring long-term monitoring and conservation of these resources.

Another watershed event in waterfowl management was the establishment of the Flyway System and the formation of Councils in each of the Atlantic, Mississippi, Central, and Pacific Flyways in 1952. These Flyway Councils, consisting of state/provincial wildlife agencies, were intended to serve as administrative vehicles to forge an effective partnership with Federal agencies to improve waterfowl research and management programs, including the development of annual hunting regulations in the United States. Canada's participation in the Flyways provides input - in the form of information exchange, coordination of research, and development of shared objectives - into developing its own hunting regulations for migratory game birds. Flyway Councils pioneered the development of science-based waterfowl management plans to set population, habitat, and harvest goals and to call for specific activities. Each of these plans were tailored to specific populations or geared towards particular waterfowl situations, flyway by flyway. Although many challenges remain, the Flyway Council System has been an effective force on behalf of waterfowl conservation for more than 50 years.

In 1986, Canada and the United States came together to establish the North American Wildlife Management Plan (Mexico joined in 1994.) The Plan identifies desirable population and habitat goals and recommends resolutions to problems facing waterfowl management on an international scale. Although the Plan remains vibrant, having extended the reach and impact of continental waterfowl conservation, as documented in Plan updates in 1994, 1998, this current document strives to re-examine the original goals and strengthen its scientific base to meet both present and future challenges. In its brief history, the Plan has achieved unparalleled success in bringing together a union of partnerships consisting of private and governmental organizations to advance the principles of waterfowl management and research on a continental scale.

Formal recognition of the cultural and dietary importance of migratory birds to Aboriginal, Native American, indigenous, and local communities can be found in the 1999 amendment to the Migratory Bird Convention. These peoples will play an increasingly active role in management decisions affecting the waterfowl resource as their communities become more fully integrated into the Plan over time.

Other alliances relevant to continental conservation include the Convention on Wetlands of International Importance Ramsar, Iran, 1971), the 1992 Convention on Biological Diversity, the 1992 North American Free Trade Agreement and the parallel North American Agreement on Environmental Cooperation, and the Tri-lateral Committee for the Conservation of and Management of Wildlife and Ecosystems.

The North American Wetlands Conservation Act of 1989 established the North American Wetlands Conservation Council (NAWCC) to review the merits of wetlands conservation proposals submitted for funding under the Act's grants program. The Council ranks and prioritizes projects based on certain biological criteria and recommendations made by joint venture management boards in the United States and by the Canadian and Mexican Federal governments. The Council recommends proposals for funding to the Migratory Bird Conservation Commission, the funding authority under the Act.

Appendix D: Plan Monitoring Needs

Functions of Monitoring

Monitoring that supports North American waterfowl conservation serves two primary functions. First, monitoring provides information needed to inform management decisions that are based upon resource status (i.e., are state-specific). Second, analysis of monitoring data can help identify the causes of population change and provide an improved basis for future management decision-making.

The nature and characteristics of monitoring programs determine the type of management decisions that can be supported and evaluated through them. Surveys designed primarily to estimate abundance and assess population trajectory can be helpful in identifying population changes and spatial pattern in change. However, they provide little support for management decision-making except to direct resources to identify the causes of population decline or overabundance. In contrast, surveys that also provide measures of environmental or other factors believed to affect population status offer some opportunity to test hypotheses about fundamental issues of population limitation and regulation. More useful yet are surveys that are tightly integrated within an explicit management decision-making process that involves biological prediction and testing so as to inform decisions while learning about mechanisms affecting population status. Abundance surveys, as well as surveys such as banding, marking, production surveys (designed to estimate vital rates), and harvest surveys, when coordinated with monitoring of natural and management-induced environmental changes, can inform management decisions and provide important insights into the mechanisms underlying population change.

Adaptive Resource Management (ARM) provides an explicit framework that ensures that monitoring data are relevant and useful in making immediate management decisions and provides a means to improve future decision-making through an iterative cycle of biological prediction and testing. Examples of practical ARM implementation are not numerous due both to institutional and technical challenges. Adaptive management of the recreational harvest of North American waterfowl, however, stands as a good example of this type of explicit decision-making process, where the role and use of monitoring data is clearly defined prior to a decision-making cycle. While the challenges are many, application of the concepts of ARM should be a high priority in the development of regional bird conservation plans and in their implementation at local scales.

Monitoring Needs

Six general monitoring needs have been identified in support of the Plan:

1) *Abundance*– Expand and enhance surveys that provide the primary means of tracking changes in waterfowl abundance to enable assessment of population status and the development of population objectives.

2) *Vital Rates and Harvest Rates*– Enhance efforts and improve methods to monitor population recruitment and survival rates as well as harvest rates to better understand mechanisms causing population change.

3) *Coordinated Environmental Monitoring*– Expand and integrate environmental monitoring at multiple scales with population surveys (abundance and vital rates) to test hypotheses about factors limiting population growth, test assumptions underlying Plan habitat conservation objectives, and evaluate Plan conservation actions.

4) *Cross-scale Integration*– Integrate and coordinate population and habitat monitoring at continental, regional, and local scales so that patterns in population or habitat change at one scale are informative of ecological processes responsible for patterns at other scales.

5) *Data Management and Accessibility*– Improve data management and retrieval protocols to provide conservation planners and researchers with rapid access to spatially-referenced waterfowl population and habitat data.

6) *New Technologies*– Implement new and emerging tracking technologies to supplement traditional monitoring databases and improve opportunities to learn about waterfowl response to environmental variation at multiple scales.

Abundance – The long history of population abundance monitoring in North America has contributed greatly to the maturation of the Plan as a vehicle for conservation delivery. While many monitoring programs were designed largely to aid in understanding the impacts of harvest regulations on waterfowl populations, retrospective analyses of these data have provided insights into habitat-population relationships that formed the cornerstone for the Plan's habitat objectives and conservation strategies. Population abundance surveys enable routine assessment of population status and the establishment of population objectives. When closely coordinated with environmental monitoring, data from abundance surveys can be useful in identifying agents of population change and evaluating the effects of conservation programs. A minimum objective is to ensure the existence of at least one reliable means of tracking changes in abundance for all North American waterfowl.

One critical element in the design of bird abundance surveys is the estimation of detection probability, since rigorous attention to issues of sampling design alone will not ensure that population estimates are reliable. This is due largely to the common situation in which counts of birds on sampling units represent some unknown fraction of those actually present. Variable detection probabilities less than one impose bias in sample-based density estimators and may bias trend estimates. In the analysis of data from waterfowl population surveys that do not address detection probability (e.g., Mid-winter Waterfowl Survey), it is common to assume either a constant detection probability over time or the absence of a long-term trend in detection probability and to use the resulting counts or estimates as indices of population size.

In practice it is likely that detection probability varies both temporally and spatially in response to environmental and operational (e.g., changes in observers, vehicles, or observation equipment) factors. It is possible to account for some factors inducing variability in detection probability within a modeling framework. However, when logistically possible, it is preferable to design surveys that include methods to directly estimate detection probability (e.g., Waterfowl Breeding Population and Habitat Survey). Recently, great theoretical advances have been made in methods for the estimation of detection probability which may be valuable in improving existing population abundance surveys and in designing new surveys for species that are inadequately covered by existing survey programs (e.g., many sea ducks).

Vital Rates and Harvest Rates– In addition to abundance surveys, the extensive annual effort to retrieve data from leg-banded, neck-collared, and otherwise marked birds has contributed substantially to the general understanding of seasonal habitat affinities of waterfowl populations, the degree of mixing among populations, philopatry and movement, and changes in vital rates that influence distribution and abundance.

Harvest and parts collection surveys, in conjunction with band recovery data, provide information on hunting mortality and age ratios in the fall population that are reflective of the past year's recruitment. Special ground or aerial productivity surveys also provide information on waterfowl recruitment. Analysis of demographic survey data has helped managers understand which population processes and periods during the annual cycle limit waterfowl population growth.

As part of multi-faceted studies to understand the effects of environmental changes on waterfowl populations, targeted year-round waterfowl banding and marking programs could enable estimation of seasonal survival rates that would be more closely associated with seasonal resource availability. Emerging tracking technologies (see *New Technologies*) show promise in both delineation of waterfowl populations and in direct measurement of vital rates. The spatially-referenced nature of tracking data also offers the opportunity to study the response of individual birds to environmental variation at multiple scales. A better understanding of ecological processes affecting waterfowl survival, recruitment, and ultimately abundance, is essential to the development of testable, model-based habitat conservation objectives that can be evaluated and improved.

Coordinated Environmental Monitoring– Environmental monitoring programs coordinated or integrated with waterfowl surveys are needed to evaluate hypotheses about the influence of habitat, weather, and management actions on population status. As a precursor to the development or enhancement of environmental monitoring strategies, alternative hypotheses about the nature of regional environmental influences on populations must be specified. These hypotheses should be codified into models that predict population responses to environmental changes. Model-based monitoring strategies might then be defined to allow discrimination among models that predict different population responses to environmental conditions or management actions.

Considerable forethought will be necessary to develop population, habitat (i.e., resource), and weather monitoring protocols at appropriate spatial and temporal scales. Model-based monitoring programs might be developed, for instance, to better understand the effects of a local-scale habitat treatment, the effects of a suite of management treatments at a landscape-level, or the effects of precipitation patterns and habitat availability on waterfowl at a regional scale. Coordinated environmental monitoring may be tightly-coupled with the population monitoring protocol (e.g., counting wet ponds while counting birds) or utilize different methodologies such as classification remotely sensed data or summarization of weather reporting station data.

Cross-scale Integration– No single appropriate spatial or temporal scale exists for waterfowl monitoring. The spatial and temporal scale of a monitoring program is dictated by the objectives of that program, specifically the management decisions it has been designed to inform. For instance, the U.S. Fish and Wildlife Service (USFWS) and the Canadian Wildlife Service (CWS) collaborate annually on the Waterfowl Breeding Population and Habitat Survey. This large-scale survey supports the annual development of national waterfowl hunting regulation frameworks, and provides a primary means of assessing the status of a number of high priority waterfowl species.

At smaller regional scales, waterfowl surveys are conducted to better understand the influence of specific environmental factors on population distribution, abundance, survival, and recruitment. A good example is the annual Four-Square-Mile Survey conducted by the U.S. Fish and Wildlife Service in the United States portion of the Prairie Pothole Region (PPR). Counts of breeding waterfowl and annual assessments of habitat condition have enabled the development of models to predict breeding waterfowl distribution and abundance. The predictions of these models are foundational to the development of regional habitat conservation strategies in the United States PPR.

Waterfowl population surveys also occur at local spatial scales and over short time intervals. Examples are special purposes surveys designed to evaluate the impact of a particular management treatment, or periodic waterfowl counts conducted on state, provincial, or Federal waterfowl management or refuge areas. Data from small-scale surveys are frequently inaccessible to all but a few researchers or managers associated with a particular facility or research project.

A limitation of monitoring programs that are scale-specific is that it can be difficult to understand the mechanisms causing patterns observed in the monitoring data. For instance, data from the Waterfowl Breeding Population and Habitat Survey can be used to detect a change in abundance, but it may be impossible to understand the mechanisms causing that change without additional information about regional demographic processes. At a local scale, changes in surveyed waterfowl abundance in a particular management area before and after a habitat modification is uninformative without some understanding of regional and even continental patterns of population abundance.

The utility of monitoring data at multiple scales suggests that some level of integration across scales is warranted. Integration might involve the formal merger of on-going survey protocols using multi-level survey designs, or be simpler such as centralized management of, or centralized access to, spatially-referenced survey data from local-scale, regional-scale, and continental-scale programs.

Data Management and Accessibility– Effective conservation planning requires an understanding of how bird populations respond to habitats at local, regional, and continental scales. Thus, an immediate challenge for biologists in developing science-based waterfowl conservation plans is accessing and understanding the content of historic and contemporary bird population and habitat data. A tremendous volume of baseline data exists, diffusely distributed among federal and state governmental agencies and non-governmental organizations. It is frequently difficult to access important data, and databases vary significantly in their level of documentation. Too often long-term databases are incomplete or unavailable electronically.

The USFWS, in cooperation with the U.S. Geological Survey's National Biological Information Infrastructure and Patuxent Wildlife Research Center, is collaborating in the development of a data center for the distribution of standardized, well-documented, spatially-referenced bird population and habitat databases. The primary intent of this data center is to provide internet access to a distributed network of databases maintained by the USFWS, USGS, and other agency and non-governmental partners in bird conservation. It is incumbent upon all agencies and organizations involved in the monitoring of bird populations or habitats to ensure that their data are professionally managed, well-documented, internet accessible, and linked to a centralized data portal such as the USFWS/USGS site described. The costs, in personnel and finances, for these data management and retrieval requirements should be considered in initial phases of survey development.

New Technologies– Innovative application of traditional methods of population survey will continue to play an important role in habitat conservation. However, because of fiscal and logistical constraints, these methods alone will not provide all the data that habitat joint ventures need in order to understand bird responses to environmental changes at multiple scales. Emerging wildlife tracking technologies hold great promise for supplementing information derived from traditional survey techniques. Plan partners must maintain an awareness of the current state of wildlife tracking technology such as recent developments in satellite telemetry and GPS-based tracking devices.

Satellite telemetry continues to evolve and enhancements such as light-weight solar recharging batteries have decreased the size of platform transmitter terminals (PTTs), making them applicable to duck-sized birds, and have extended the life of individual PTTs. Satellite telemetry, however, remains a costly tracking alternative and its spatial precision (hundreds of meters) , while sufficient to identify broad-scale patterns in movement, limits its use in evaluating how birds are responding to environmental changes and disturbances at a local scale. A combination of local observational studies and satellite tracking studies, however, might help elucidate factors affecting bird distribution, movement, and abundance.

GPS-based tracking of duck sized birds is not yet feasible. While a GPS receiver today is little more than a microchip, battery technology, antenna configuration, and transmitter limitations still constrain efforts to miniaturize GPS-based PTTs. With continued expansion of GPS commercial markets, the trend toward miniaturization should continue to the point where this technology is applicable and cost-effective for waterfowl. The spatial precision of GPS derived waterfowl positions, in conjunction with geo-spatial environmental databases, would enable modeling of factors affecting waterfowl distribution, movement, and abundance throughout the annual cycle at various scales and testing key planning assumptions.

These new tracking technologies as well as other tools such as genetic markers and stable isotope methods are also providing managers with more effective means to delineate discrete population segments that might be candidates for individualized management strategies. Identification of population segments also facilitates the interpretation of patterns observed in population monitoring data, helping managers identify population segments that may be increasing or declining and target conservation resources appropriately.

Monitoring Responsibilities

Primary responsibilities in meeting monitoring needs for North American waterfowl conservation are described for the NSST, Federal agencies responsible for migratory bird conservation, and joint ventures.

NSST– As the principle technical advisory body to the International Plan Committee, and the primary vehicle for cross-joint venture collaboration, it is incumbent on the NSST to describe a vision for a coordinated multi-scale monitoring strategy that: a) ensures a monitoring protocol exists for each species that provides reliable estimates of absolute abundance during some portion of the annual cycle, b) identifies a cohesive set of regional population and habitat monitoring programs necessary to better understand regional factors affecting continental waterfowl populations and promote ongoing refinement of habitat conservation objectives and strategies, and c) identifies opportunities for collaboration in population and/or habitat monitoring with other bird conservation initiatives.

Federal Management Agencies– As the agencies with primary statutory responsibility for the management and conservation of migratory birds, it is incumbent on the USFWS, CWS, and SEMARNAT to document resource requirements for meeting the objectives of the monitoring strategy described by the NSST as well as requirements associated with other responsibilities such as the regulation of waterfowl harvest. The Federal management agencies in each country should seek to develop and implement effective programs to monitor absolute abundance of all North American waterfowl species in conjunction with other governmental partners. The Federal agencies should continue to support monitoring necessary for the effective regulation of recreational and subsistence harvest of waterfowl. These agencies should also lead in the development of a monitoring data management infrastructure that provides internet access to standardized, well-documented, spatially-referenced databases. This should be a distributed infrastructure providing internet links to the data resources of these agencies, to joint ventures, and to other individual joint venture partner organizations. Lastly, the Federal migratory bird management agencies should provide technical expertise and operational support for the development of regional monitoring strategies as resources permit.

Joint Ventures– It is the responsibility of joint venture technical committees to participate on the NSST in order to develop a cohesive continental monitoring strategy to support waterfowl habitat conservation. It is the responsibility of joint ventures to specify hypotheses about the primary environmental factors affecting waterfowl distribution and abundance and, in cooperation with the NSST, to describe regional and local-scale monitoring protocols needed to evaluate alternative hypotheses and refine habitat conservation objectives and strategies. It is also the responsibility of joint ventures to develop partnerships to fund necessary monitoring priorities and to promote the monitoring resource needs of the Federal migratory bird management agencies to governmental appropriators in Canada, Mexico, and the United States.

Detailed Assessment of Population Abundance Monitoring Needs

The scale-specific monitoring programs required to identify the causes of population change or to evaluate specific management actions are many and varied. While the importance of this function of monitoring for effective management cannot be overstated, it is beyond the scope of this continental strategic plan to outline all these needs in detail. More within the scope of the Plan, this section focuses on identifying monitoring necessary to provide at least one reliable means of estimating absolute abundance of all North American ducks, geese, and swans.

Two general principles pertain to the survey needs identified in this section. First, survey programs should be guided by statistical objectives that are derived from explicit consideration of the needs of decision makers. Second, to be most useful, monitoring programs, including abundance monitoring, should be guided by and integrated within a management decision process that includes biological prediction (i.e., about factors influencing population status) and testing. Environmental covariates believed to have large effects on population status should be monitored coincidentally with population abundance and vital rates.

North American waterfowl monitoring programs represent, arguably, the most extensive coordinated wildlife monitoring programs in the world. Yet, despite the substantial effort expended to track population abundance and assess trend, many North American waterfowl populations are currently not monitored sufficiently to estimate population size, detect a population trend, or establish a population objective. Some species are distributed partly or entirely outside the bounds of existing population surveys. This is particularly true for sea ducks, which primarily breed in remote boreal and arctic regions and winter in open water habitats that are difficult and dangerous to survey. Additionally, broad-scale breeding surveys were optimally timed for specific dabbling ducks and lead to poor population estimates for species -- such as some diving ducks and sea ducks-- that migrate and breed later. Also, methods to estimate and adjust for detection probability, while well developed for waterfowl sample surveys, are ineffectively implemented in some regions, particularly inaccessible boreal areas. This can lead to biases in trend estimation due to observer and aircraft changes and other unaccounted for effects.

At present, there is not consensus among waterfowl biologists about the most practical and efficient means to monitor status of all waterfowl populations. The material presented in this section is intended to encourage, rather than discourage, continued debate over survey methodologies for specific populations.

Dabbling Ducks – The dabbling ducks, with exceptions, are probably the best monitored group of waterfowl in North America. Cooperative breeding grounds surveys established by Canada and the United States in 1955 focus on primary breeding areas for dabbling species and are optimally timed to estimate their abundance, particularly for early nesting species such as the mallard. Over the past several decades, many states and provinces have initiated complementary breeding waterfowl surveys and the United States and Canadian Federal governments have expanded breeding surveys into eastern regions of Canada. Concern, however, remains about the low intensity of sampling in the vast boreal regions of Canada and Alaska.

Existing breeding grounds surveys provide a reasonable means to track population trends for most dabbling species. There are, however, exceptions. Green-winged teal, for instance, occupy a very broad breeding range. While state-provincial surveys and expanded Federal breeding population surveys in eastern Canada have improved coverage for this species, significant portions of its breeding range in northern Canada and Alaska are not surveyed. Expansion of breeding grounds surveys into additional Arctic regions of Canada and Alaska will be necessary to more completely cover the breeding range of this species.

Blue-winged teal and cinnamon teal pose different challenges in estimating population size. Observed from the air, these species are difficult to distinguish and estimates have traditionally been combined. Since 1986 the Plan has included a combined population objective for blue-winged and cinnamon teal to be consistent with their combined estimation. Within the region traditionally surveyed by the United States and Canadian Federal governments, significant breeding range overlaps occur in Montana, the western Dakotas, and southern Alberta. Likewise range overlaps occur within several western states and provinces where breeding waterfowl surveys are conducted. One possibility for deriving separate population estimates for blue-winged and cinnamon teal would be to estimate species proportions in areas of range overlap using data collected by ground crews for the purpose of visibility-bias correction. Another challenge in estimating abundance of cinnamon teal is that a large proportion of this species breeding range is presently un-surveyed in Mexico and the States of Idaho, Arizona, New Mexico, Kansas, Oklahoma, and Texas. New surveys would be necessary to improve coverage for cinnamon teal in these areas.

The northern pintail migrates very early in the spring, occupying breeding habitats shortly after they become ice-free. In addition the pintail initiates breeding activities earlier than other ducks. The early initiation of breeding by pintails creates some concern about the potential to undercount this species during the traditional WBPHS since incubation may have already begun prior to survey flights. One way to overcome this limitation in present survey protocols would be to conduct a separate breeding population survey optimally timed earlier in the spring for pintails. Such a survey would be partly coincidental with the WBPHS conducted in May.

Neither of the two populations of mottled ducks in North America, the Florida Population, or the Western Gulf Coast Population, is adequately covered by breeding surveys. The mid-winter index is considered unreliable for this species in Florida, so a significant portion of the mottled duck breeding range in that state is surveyed annually. The exact proportion of the Florida population that is surveyed, and the consistency of this proportion, is unknown, however. The only breeding season surveys of Western Gulf Coast mottled ducks occur on transects of some National Wildlife Refuge lands in Texas, and are not designed to produce an estimate of abundance for any portion of the species' range. An experimental survey of the lower and middle Texas coast holds promise for obtaining breeding population estimates for this region.

There remains, however, a need to develop protocols and expand survey efforts to include Louisiana and the Chenier Plain of Texas to produce a reliable, annual population estimate for Western Gulf Coast mottled ducks.

Perhaps no other species of North American waterfowl presents as much a challenge to the design of protocols for monitoring population abundance as the wood duck. The breeding range of wood ducks lies largely outside areas in which state, provincial and Federal cooperative breeding population surveys are conducted. Where aerial survey coverage does overlap wood duck breeding range, the densely wooded habitats this species occupies makes population estimation impossible. Ground-based breeding population surveys conducted by 11 northeastern states do provide wood duck population estimates but cover only a small fraction of the wood duck's breeding range. The North American Breeding Bird Survey, a volunteer-run point count survey coordinated through the Patuxent Wildlife Research Center, has shown promise as a means of monitoring wood duck relative abundance and trend. However, this survey does not routinely incorporate methods to allow for the estimation of detection probability, so estimation of absolute population abundance is not possible. Repeated measures by different observers might provide a means of estimating detection probability and enable estimation of absolute abundance. New applications of solicited band recovery data obtained from the harvest parts collection survey are currently being explored and also hold promise for estimating absolute abundance of this species using a simple, two-sample Lincoln-Peterson type estimator.

The Mexican duck, muscovy duck, and the fulvous and black-bellied whistling ducks are poorly surveyed throughout their range. Of the group, more baseline data exists for the Mexican duck. Mid-winter estimates are available for some of these species for certain regions in Mexico surveyed cooperatively by the United States and Mexican Federal governments every 1 to 3 years. Mid-winter counts for these species are generally not considered reliable indices to population status and there is a need for coordinated aerial and ground-based breeding population surveys. There may be potential to monitor breeding populations of the whistling ducks along the Texas Gulf Coast in association with mottled duck surveys as they are developed. New, and as yet undefined, surveys will be necessary in Mexico.

The two resident endemic Hawaiian duck species, the Hawaiian Duck and the Laysan duck are presently monitored during the annual Hawaiian Waterbird Survey. This survey is not considered adequate for these species and review of survey protocols is on-going.

Diving Ducks – Cooperative breeding grounds surveys presently cover most of the breeding range of diving ducks in North America. An exception is the redhead for which a substantial segment of the breeding population remains un-surveyed in the Great Basin region of the northern U.S. Rocky Mountains. The cooperative breeding ground surveys surveys, in general, are not optimally timed for most diving ducks. The redhead, ruddy duck, and scaup species exhibit protracted migration chronologies, and nesting activity occurs later in spring than for many dabblers. These facts have raised some concern about the potential for double-counting migrating birds as they pass through adjacent survey strata. It is possible that aerial transects could be repeated later in the spring to derive better breeding population estimates for diving ducks as well as for sea ducks.

Scaup have traditionally not been identified to species during aerial waterfowl surveys. It is possible to distinguish the species in flight under good lighting conditions, however, on the water the species cannot be distinguished during aerial surveys. The greater scaup breeds almost entirely in the Arctic and are the most abundant scaup in tundra regions. Lesser scaup have a much broader breeding range that extends south through the prairie-pothole region. Lesser scaup occupy boreal forests of northwestern Canada and interior Alaska at much higher densities than greater scaup. Because of differences in primary breeding habitats, populations have been roughly estimated for the individual species by segregating tundra and boreal forest strata (Table 2). This is an imperfect solution since mixing of breeding populations occurs in both habitat types. Derivation of improved species-specific population estimates may require ground surveys conducted in conjunction with existing aerial surveys. Additionally, a significant proportion of the greater scaup breeding range is presently un-surveyed in the Yukon and Nunavut and would require expansion of the geographic scope of the Waterfowl Breeding Population and Habitat Survey.

The masked duck is widespread but occurs at relatively low densities throughout its range extending from South America to central Mexico and the Caribbean. It is secretive and inhabits densely vegetated lakes and wetlands, also frequenting mangroves during the non-breeding season. It is not known to congregate in large numbers. Little work has been conducted on protocols for monitoring masked ducks. Its habits may render aerial-based surveys less effective than coordinated ground-based programs.

Sea Ducks – Sea ducks are poorly monitored by traditional waterfowl surveys and information on population size and trend for most species is unreliable. The Federal, state, and provincial cooperative breeding waterfowl surveys, conducted in spring and used as a basis for setting population goals for many North American waterfowl, do not cover the core breeding ranges of about half the sea duck species. These surveys are not optimally timed for sea ducks, which generally nest later than dabbling ducks. Despite the limitations of existing data sets, populations of several sea duck species are strongly suspected to be in decline. There is an urgent need for more intensive, precise surveys that will provide an index to population size for long-term monitoring and robust detection of trends for all sea duck species.

In some instances, multiple species could be monitored with generalized survey protocols, whereas certain species will require individualized surveys due to their restricted range or isolated habitats. Generally, surveys will be required on an annual basis to achieve sufficient power to detect trends in a reasonable time frame. There may be instances where a population can be monitored less frequently; for example, intensive counts of common eiders in nesting colonies are generally more accurate than traditional surveys and might be repeated at longer (e.g., 5-yr) intervals.

One option for monitoring breeding populations of some sea duck species is another large-scale survey similar to the existing cooperative breeding waterfowl survey conducted by the United States and Canada, but flown later and over a larger geographic area. A comprehensive survey of this type would require significant commitments in aircraft, personnel. Despite logistical and fiscal impediments, breeding grounds surveys may be the most feasible approach for many sea ducks since severe logistical constraints (e.g., weather) and cost concerns (e.g., charter aircraft, weather related down-time) can make winter surveys difficult, particularly in northern areas.

For some sea ducks, however, it may be more efficient to monitor population status through coordinated winter surveys. Due to sea ducks' concentration at coastal wintering areas, winter surveys may be more cost effective than breeding ground surveys in some instances. Studies are also beginning to show that some species of sea ducks are highly philopatric to winter ranges. To date, a winter survey adequate for sea ducks does not exist on either coast. Mid-winter inventories are geographically restricted and include inland and near-shore habitats, but not deepwater areas commonly used by sea ducks. On the Atlantic coast, a near-shore aerial survey designed to provide an index of sea ducks wintering in coastal habitats was initiated in 1990, but high variability in annual indices suggest that significant improvements in design are necessary to increase its utility in detecting trends. Efforts are underway to improve this survey by identifying important offshore concentration areas along the Atlantic seaboard. Initial results indicate substantial use of offshore shoal areas, however there appears to be significant movement among shoal habitats among years and within a single winter season.

On the Pacific Coast, only piecemeal surveys have been conducted at sporadic time intervals. An improved Atlantic sea duck survey (including the Great Lakes) and a coordinated survey effort from Alaska to California should be considered. Species that could potentially be monitored through winter surveys include all three species of scoters, the American race of common eider, goldeneyes, bufflehead, harlequin ducks, and red-breasted and common mergansers. Conversely, winter surveys would probably be inappropriate for those sea duck species that breed in North America but winter elsewhere where no regular surveys occur. For example, some king eiders, common eiders, and harlequin ducks breeding in eastern North America winter in Greenland, and some common eiders, king eiders, and long-tailed ducks breeding in western North America winter in Russia. Effective monitoring of the hooded merganser, a species that breeds in cavities and inhabits densely wooded regions may require strategies similar to those recommended for the wood duck.

Geese – The general objective for goose monitoring is to develop and/or maintain, at a minimum, periodic population assessments of all recognized goose populations. For some of these populations, a cost-effective, logistically feasible survey methodology has yet to be devised. Highest priority for survey development, however, has been for those populations subject to significant harvest pressure or those whose status is a matter of concern. In some instances a number of goose populations gather in mixed flocks on their wintering and migratory ranges, making population inventory difficult. In these cases, a high priority is the development of breeding surveys conducted at a time when populations are segregated.

Of the 20 populations of Canada geese described in this Plan, 7 have operational breeding grounds surveys. Improvement of these breeding population surveys is a continuing priority. Tall-Grass Prairie, Short-Grass Prairie, Western Prairie and Great Plains, Hi-Line, Rocky Mountain, Dusky, and Aleutian populations are presently monitored entirely or partially through mid-winter or special purpose surveys. Unfortunately, surveys conducted on the wintering grounds can be difficult to interpret because of mixing that occurs among populations. There are presently no operational means of monitoring population abundance for Taverner's, Pacific, Lesser, and Vancouver populations, although work is underway on surveys for the Taverner's, Pacific, and Lesser Canadas. The Lesser and Taverner's populations are presently partially and inadequately surveyed during the WBPHS and the Arctic Coastal Plain Survey. Several states and provinces conduct surveys of the Pacific Population, however, these surveys are not yet sufficiently coordinated to provide a composite index of abundance for this population. Lastly, the geographic breeding range of North Atlantic Population of Canada Geese is presently being re-examined. Currently survey protocols are believed to be insufficient for this population.

The Greater Snow Goose occupies a large breeding range extending from northern Foxe Basin and central Baffin Island to Ellesmere Island and northwest Greenland. Comprehensive breeding grounds surveys would present great logistical and financial challenges. Presently Greater Snow Geese are monitored through a photographic inventory conducted annually along 400 km of the St. Lawrence River and estuary. This has proved a cost-effective means of monitoring status of this population. In 2001, an expanded version of this survey was initiated because of an increasingly widespread distribution and more frequent inland dispersal of geese to feed in agricultural fields. This expanded survey should be continued.

Currently, the Mid-Continent and the Western Central Flyway populations of lesser snow geese are monitored through mid-winter waterfowl surveys. However, mixing of populations with Ross's geese on the wintering grounds can make estimation of population size difficult. A photographic inventory of Canadian lesser snow goose breeding colonies takes place at periodic intervals. Ross's geese are also monitored periodically using photographic inventories of breeding colonies. Several major Ross's goose breeding colonies have been inventoried annually since 1993. Coordinated ground surveys are required to separate Ross's geese from sympatric lesser snow geese. Additional resources are necessary to implement photographic breeding colony inventories for other populations and to increase the frequency of monitoring of lesser snow and Ross's goose breeding colonies.

The Mid-Continent Population of white-fronted geese is presently indexed in the fall using an aerial census of staging birds in prairie Canada, supplemented with simultaneous reports of minor concentrations elsewhere. There is need, however, for additional survey effort directed at the portion of this population breeding in Alaska. Abundance of the Pacific Population of white-fronts is monitored through an annual breeding population survey. The status of Tule White-fronted Geese has been assessed using special purpose surveys in the past, and a reliable, operational methodology for an annual or periodic inventory is still in development.

Winter surveys are used to monitor the status of the four recognized populations of brant in North America. The mid-winter survey appears to perform well in indexing long-term population change of Atlantic Brant and this survey should be continued at present levels of effort and geographic coverage. Pacific Brant breed over a vast region encompassing portions of Alaska, Arctic Canada, and Russia. Little is known about the sub-population structure of Pacific Brant and marking studies and genetic investigations are needed to better define sub-populations. Western High Arctic Brant breed on the Parry Islands of the Northwest Territories, stage at Izembek Lagoon with Pacific brant, and winter in northern regions of Puget Sound. As with Pacific Brant, additional work is needed to more precisely delineate and define this stock of birds. Operational surveys to monitor breeding populations at major Pacific Brant colonies should be evaluated, and could become important if population delineation studies define distinct sub-populations. Efforts are also underway in Alaska to refine estimates of dispersed-nesting (non-colonial) brant. For Western High Arctic Brant, winter surveys should be expanded to include all potential wintering areas. Alternatively, breeding population surveys of the Parry Islands, or a survey of birds staging in Izembek Lagoon (where they occupy a portion of the Lagoon separate from Pacific Brant), could provide an adequate means of inventory. Eastern High Arctic Brant are monitored annually on their wintering grounds in Ireland.

The abundance of Emperor Geese breeding in North America is adequately monitored in the U.S. through the annual Emperor Goose Spring Population Survey. This survey is conducted in Alaska during May at a time when the population is most concentrated. Additional effort is needed to monitor the component of this population breeding in Russia.

The Hawaiian Goose is monitored through the annual Hawaiian Waterbird Survey. This survey is not considered adequate for this species and efforts to improve protocols are continuing.

Swans – Population abundance of both the Eastern and Western Populations of tundra swans is adequately indexed through the mid-winter waterfowl survey. Any proposed changes in the intensity or geographic coverage of the Pacific or Atlantic Flyway mid-winter surveys should be reviewed to ensure that they do not affect the usefulness of these surveys for monitoring tundra swans. In the case of trumpeter swans, a number of regional surveys exist to monitor components of the three populations currently recognized in North America. However, Flyway management plans for all three populations have utilized the long-running and comprehensive North American Trumpeter Swan Survey as the basis for setting population objectives and monitoring population change. Despite the small size of trumpeter swan populations, comprehensive monitoring of population abundance at 5-year intervals is sufficient given the number of smaller-scale regional surveys that track shorter-term changes in certain population segments. Alternatively, consolidation of the resources expended on all trumpeter swan surveys may enable more frequent monitoring through the comprehensive North American Trumpeter Swan Survey.

Appendix E: Taxonomy of North American Waterfowl

FAMILY:	Anatidae	Ducks, Geese, and Swans	
SUBFAMILY:	Anatinae	Ducks	

TRIBE: Anatini — Dabbling Ducks and Perching Ducks

Anas platyrhynchos platyrhynchos	Mallard
Anas platyrhychos diazi	Mexican Duck
Anas acuta acuta	Northern Pintail
Anas rubripes	American Black Duck
Anas fulvigula fulvigula	Mottled Duck, Nominate Race
Anas fulvigula maculosa	Mottled Duck, Western Gulf Race
Anas strepera	Gadwall
Anas americana	American Wigeon
Anas crecca carolinensis	Green-winged Teal
Anas discors	Blue-winged Teal
Anas cyanoptera septentrionalium	Cinnamon Teal
Anas clypeata	Northern Shoveler
Anas wyvilliana	Hawaiian Duck
Anas laysanensis	Laysan Duck
Aix sponsa	Wood Duck
Cairina moschata	Muscovy Duck

TRIBE: Aythyini — Diving Ducks or Pochards

Aythya americana	Redhead
Aythya valisineria	Canvasback
Aythya affinis	Lesser Scaup
Aythya marila mariloides	Greater Scaup
Aythya collaris	Ring-necked Duck

TRIBE: Oxyurini — Stiff-tailed Ducks

Oxyura jamaicensis jamaicensis	Ruddy Duck
Nomonyx dominicus	Masked Duck

TRIBE: Mergini — Sea Ducks

Histrionicus histrionicus	Harlequin Duck
Clangula hyemalis	Long-tailed Duck
Somateria spectabilis	King Eider
Someteria mollissima v-nigra	Common Eider, Pacific Race
Somateria mollissima borealis	Common Eider, Northern Race
Somateria mollissima dresseri	Common Eider, Southern Race
Somateria mollissima sedentaria	Common Eider, Hudson Bay Race
Somateria fischeri	Spectacled Eider

Polysticta stelleri	Steller's Eider
Melanitta nigra americana	Black Scoter
Melanitta fusca deglandi	White-winged Scoter
Melanitta perspicillata	Surf Scoter
Bucephala clangula americana	Common Goldeneye
Bucephala islandica	Barrow's Goldeneye
Bucephala albeola	Bufflehead
Lophodytes cucullatus	Hooded Merganser
Mergus merganser americanus	Common Merganser
Mergus serrator	Red-breasted Merganser

SUBFAMILY: Dendrocyninae Whistling Ducks

Dendrocygna autumnalis autumnalis	Black-bellied Whistling Duck
Dendrocygna bicolor	Fulvous Whistling Duck

SUBFAMILY: Anserinae Geese and Swans

TRIBE: Anserini

Branta canadensis canadensis	Canada Goose, Nominate Race
Branta canadensis interior	Canada Goose, Interior Race
Branta canadensis occidentalis	Canada Goose, Dusky Race
Branta canadensis fulva	Canada Goose, Vancouver Race
Branta canadensis maxima	Canada Goose, Giant Race
Branta canadensis moffitti	Canada Goose, Western Race
Branta canadensis taverneri	Canada Goose, Taverner's Race
Branta canadensis hutchinsii	Canada Goose, Richardson's Race
Branta canadensis parvipes	Canada Goose, Lesser Race
Branta canadensis leucopareia	Canada Goose, Aleutian Race
Branta canadensis minima	Canada Goose, Cackling Race
Branta bernicla hrota	Brant, Atlantic Race (Light-bellied)
Branta bernicla nigricans	Brant, Pacific Race (Dark-bellied)
Branta sandvicensis	Hawaiian Goose
Anser albifrons frontalis	Greater White-fronted Goose, Pacific Race
Anser albifrons gambelli	GreaterWhite-frontedGoose,Gambelli Race
Anser albifrons elgasi	Greater White-fronted Goose, Tule Race
Chen caerulescens caerulescens	Snow Goose, Lesser Race
Chen caerulescens atlanticus	Snow Goose, Greater Race
Chen rossii	Ross's Goose
Chen canagica	Emperor Goose

TRIBE: Cygnini

Cygnus olor	Mute Swan (Feral)
Cygnus buccinator	Trumpeter Swan
Cygnus columbianus	Tundra Swan

References:
The sequence and naming of Subfamilies and Tribes follows Livezey (1986). The naming of genera and species within genera follows Johnsgard (1978) and American Ornithologists' Union (1983). The naming of races within species follows Bellrose (1980), Madge and Burn (1988) including reference works used in these compilations, and McCraken et al. (2001).

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